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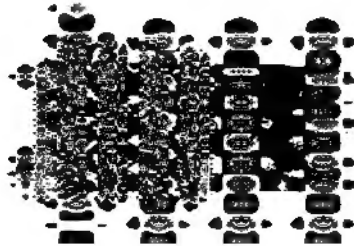
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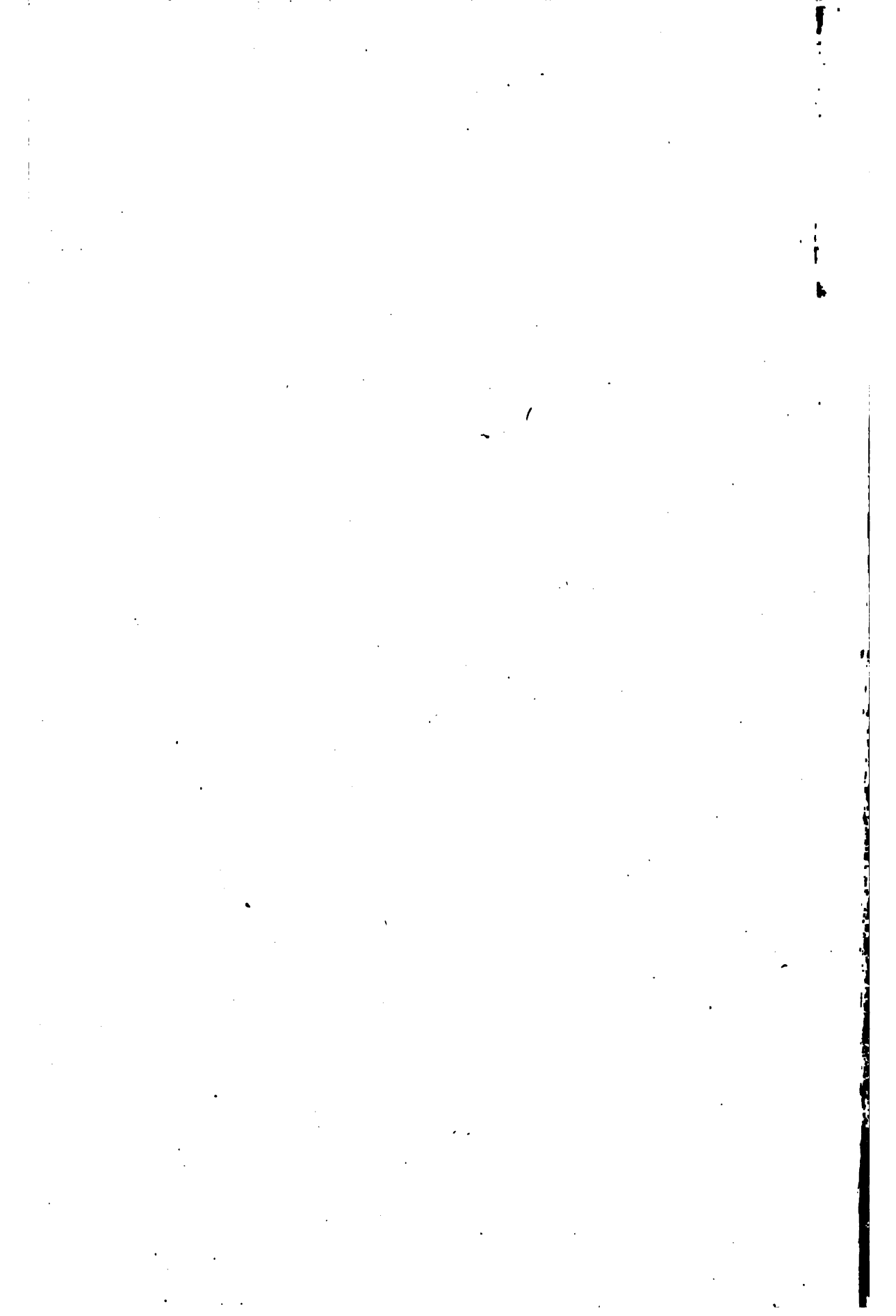
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NOTES ON THE DEVELOPMENT OF A CHILD

BY

MILICENT WASHBURN SHINN, CAND. PHIL.

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NOTES ON
THE DEVELOPMENT OF A CHILD

By

MILICENT WASHBURN SHINN, CAND. PHIL.

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INTRODUCTION.

It is a well-recognized fact in the history of science that the very subjects which concern our dearest interests, which lie nearest our hearts, are exactly those which are the last to submit to scientific methods, to be reduced to scientific law. Thus it has come to pass that while babies are born and grow up in every household, and while the gradual unfolding of their faculties has been watched with the keenest interest and intensest joy by intelligent and even scientific fathers and mothers from time immemorial, yet very little has yet been done in the scientific study of this most important of all possible subjects,—the ontogenic evolution of the faculties of the human mind. Only in the last few years has scientific attention been drawn to the subject at all. Its transcendent importance has already enlisted many observers, but on account of the great complexity of the phenomena, and still more the intrinsic difficulty of their interpretation, scientific progress has scarcely yet commenced.

What is wanted most of all in this, as in every science, is *a body of carefully observed facts*. But to be an accomplished investigator in this field requires a rare combination of qualities. There must be a wide intelligence, combined with patience in observing and honesty in recording. There must be also an earnest scientific spirit, a loving sympathy with the subject of investigation, yet under watchful restraint, lest it cloud the judgment; keenness of intuitive perception, yet soberness of judgment in interpretation.

Now I am quite convinced, from my intimate acquaintance with her, and especially from a careful examination of her work,

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that Miss Shinn possesses many of these qualities in an eminent degree. The careful, painstaking, patient, intelligent character of her observations must be evident to every reader. The perfect honesty of the record and the really earnest scientific spirit in which the investigation is undertaken and pursued to the end, are equally certain. I am sure, too, I easily detect evidence of the loving, sympathetic relation with the subject, necessary for insight and yet not sufficient to obscure the judgment.

I am quite convinced, therefore, that the observations herein recorded are thoroughly reliable. If so, it is impossible to overestimate their importance. Of course, interpretation must go hand in hand with observation and record; and interpretation in a subject so difficult, must be more or less doubtful; but Miss Shinn has shown singular wisdom in the caution and modesty with which she draws her conclusions. I feel quite confident that the work as a whole deserves, and will receive, the thoughtful attention of Psychologists as a valuable addition to the materials of their science.

JOSEPH LE CONTE.

NOTES ON THE DEVELOPMENT OF A CHILD.

THE child of whose development the following record was kept was born and has continuously lived on a fruit ranch near Niles, in the neighborhood of San Francisco Bay. Her parentage is purely American, all four grandparents being descended from early colonists, — three from New England settlers, the fourth from New Jersey and Virginia Quakers. I have a detailed record of the conditions of health and longevity of her kin for two generations preceding her; in general these were good, and there is in none of the four grandparental lines any family tendency to disease of any sort.

The temperaments of both parents are sanguine, fond of pleasure and change. The education of the father was a university special course in history and sociology, taken after thirty years of age; the earlier education was considerable but unsystematic, mainly literary and historical. That of the mother was systematic through the high school period, ending at seventeen years. The occupation of the father up to the time of her birth had been chiefly journalistic and literary; of the mother, teaching for two years before marriage; her remoter ancestors were almost all farming and seafaring people. The ages of her father and mother at the time of her birth were respectively thirty-eight and twenty-two years.

She was at birth a strong, active, good-natured baby, without defect, and her health has been (now up to the last quarter of the third year) practically perfect. She was born two weeks late, — a point that may have some bearing on the rapidity of early development. The conditions of climate and opportunities for outdoor life have been singularly favorable.

She has been the only child in a large household of grown people, and the object of a great deal of attention. She has never been for an hour in the care of a servant, has never been secluded in a nursery, but kept in the midst of the family. She has been taken

about a great deal with her parents upon short railroad and hotel trips. The general tendency of her environment has been in my judgment toward developing a liking for change and excitement, and unfavorable to continuous attention.

The record as here given is an abstract of copious notes kept from day to day, set down in many cases instantly upon the occurrence, and always very promptly. I have admitted in a few instances occurrences reported to me by the child's mother and grandmother, but none reported by any other person (except two in the first month by the nurse); in these cases I have always stated that the note was at second hand. I am under obligation throughout to the mother for invaluable co-operation.

MEASUREMENTS.¹

—	Weight.	Height.	—	Weight.	Height.
At birth ...	9 lbs. (naked) ...	19 in.	At 13 mos.	22½ lbs.....	28¼ in.
" 1 mo..	11 " (in clothes)	19½ "	" 14 " ..	23 "	29 "
" 2 " ..	13 "	21½ "	" 15 " ..	24½ "	29½ "
" 3 " ..	15 "	23 "	" 16 " ..	25 "	29¾ "
" 4 " ..	(measurement unsatisfactory)		" 17 " ..	25½ "	30 "
" 5 " ..	17¾ lbs.	24 in.	" 18 " ..	26 "	31 "
" 6 " ..	19¼ "	25 "	" 19 " ..	26 "	31 "
" 7 " ..	20 "	26½ "	" 20 " ..	26 "	31 "
" 8 " ..	21 "	27¾ "	" 21 " ..	27 "	32¼ "
" 9 " ..	21½ "	27 "	" 22 " ..	— "	— "
" 10 " ..	21 "	27½ "	" 23 " ..	27½ "	32¾ "
" 11 " ..	22 "	28 "	" 24 " ..	28 "	33 "
" 12 " ..	23 "	28½ "			

Girth around breast, in first month, 15 inches; at six months, 17½ inches; at one year, 18½ inches.

The measurements of height during the first year seemed to me of little value, because the child's struggling disconcerted them, in spite of every care. Each measurement, however, was repeated three or four times. They were taken by holding the baby straight upon a sheet of cardboard, the head against a fixed point, and marking at the heels. The measurement of height at eight months seems certainly wrong.

At twelve months the measurement was taken both by laying her upon a sheet of cardboard, and by having her stand against the wall. Standing she measured 28 inches. During the second year, the measurements were taken standing, each one three times or more. The child was interested in the process, and tried to stand still and straight.

I have compared the record of weight carefully with my notes

¹ Following Galton's charts.

as to the child's health, appetite, spirits, etc., but without finding a constant relation. During the first half year the weight increases without any marked fluctuation, though between the third and fifth months the ratio declines, and this may be due to the fact that near the end of the fifth month the mother's nursing was slightly supplemented by other food; after this change she was a little fretful for about a week; she also had two teeth coming, which were cut just after the close of the month. In the ninth and tenth months six more teeth were cut, and during these months and the eleventh she was weaned; during the eleventh her appetite was noticeably diminished, and she had several slight colds and touches of digestive derangement, and during the twelfth a persistent cold. Yet the only month that shows any falling off in weight, or even any marked check in increase, is the tenth.

In the second year again the only month that shows a decrease of weight is the thirteenth, in which no reason appeared for this beyond a slight digestive derangement in the third week, with impaired appetite. During the fifteenth month the increase in weight is especially large and an increase of appetite was noticed; yet by this month dentition had fairly begun again, and the first molar came through early in the month. In the rest of the year, the increase in weight month by month is very uniform¹ except for a check in the nineteenth and twentieth, and another somewhere between the twenty-first and twenty-third. Yet the teething was distributed quite equally through these months to the end of the nineteenth, with accompanying rash; and she had more or less cold each month before the twentieth. The severest cold and cough was in the nineteenth month, and was quite enough to account for the check in increase of weight; but no corresponding reason for the continued check in the twentieth appeared; nor, on the other hand, does any marked increase in weight attend the perfect physical vigor after the completion of dentition. In the seventeenth month and thereafter till the twenty-third, a vague loss in gayety and physical buoyancy was quite perceptible, though there was almost no fretfulness, and the child's muscular strength was considerable, for late in the eighteenth month (538th day) she

¹More rigidly so as the scales recorded no fractions under half pounds.

picked up with one hand a flatiron, which weighed seven pounds, and walked off a yard or two with it. In the latter part of the year, and especially the twenty-fourth month, she seemed overflowing with physical energy, often jumping about and squealing in sheer exuberance of spirits. Yet her increase of weight was the same in the seventeenth and twenty-fourth months.

A weekly record would very likely give clearer results.

SIGHT.

1. Sensibility to Light.

The child seemed quite conscious of the difference between light and darkness the first day. At about an hour old, she stopped crying instantly when a cover was lifted from her face; and her eyes certainly turned toward any person who came near her, from this time on through the first and second weeks. As she did not really *look at* anyone before the fourth week, I could only suppose that she saw an approaching person as an interruption of the light; her eyes turned toward us, however, when we did not pass between her and the window. The nurse said that her head and eyes turned toward the lamp from the first night on.

In the third, fourth, and fifth weeks she gazed at light surfaces with apparent satisfaction, especially the light of the lamp on the ceiling, the face of one holding her, if it was turned toward the light, and most of all her mother's forehead, where the wave of dark hair rolled away, contrasting with the white skin. On the twenty-first day her mother and grandmother noticed her steady gaze at a black silk dress crossed with white stripes.

The twenty-fifth day I observed convulsive shutting of the eyes against dazzling light, or against moderate light after sleep or after darkness, exactly as described by Preyer; at moderate light under other conditions the baby gazed with apparent comfort.

In the fifth week, twenty-ninth day, she first went outdoors; she seemed to dislike the light, and kept her eyes shut.

After this, pleasure in gazing at bright surfaces was gradually displaced by interest in faces. In the sixth week, however, the baby gazed a good deal at the angle of the ceiling and wall where a dark border joined the light ceiling. In the seventh week (forty-seventh day) she stopped in the midst of fretting to gaze through an open window at white clothes hanging in the sunlight.

In the twenty-fifth week she was evidently interested in producing a change of light in playing "peekaboo;" when a handker-

chief was thrown over her face she would first stare about the room through it some seconds, then pull it off.

In the second year, the difference of light and darkness was a matter of a good deal of interest. In the twentieth month, 590th day, I saw her outdoors, especially when driving, cover her eyes several times with her hands. I thought the sunlight might be too brilliant, but it is more likely she was experimenting, for in the following weeks she would often cover her eyes with her hands and take them away; hide her face in a cushion, or on her own arms, often saying, "Dark!" then look up,—"Light now!" The 598th day, on waking, her first remark was "Light. Aunty make light," pointing to a place on the wall where the light must have fallen from a concealed candle I had lit in the night. The 611th day I was told she pointed to a mass of dark clouds hanging low, and said, "Dark over there." The same day, after hearing a story about the moon that interested her much in the twentieth and twenty-first months, she asked over and over, "Dark?" Answered, "No, it was light after the moon came," she would say, "Light now?" or "Dark? No." She then buried her face in a cushion; then looked under the cushion, saying softly, "Dark," then down behind the lounge, saying, "Dark there." When a curtain was raised higher, producing a change in the light, she would comment at once, "Light." I was told that on a railroad trip, 641st day, she made no comment on entering tunnels, but regularly ejaculated, on emerging, "Light!"

In the twenty-third month, 699th day, the moonlit garden, seen from the window, seemed to be quite a strange place to her; she did not recognize objects, and when I spoke of the lilies, *e. g.*, would say, "Where lilies?"

In the twenty-fourth month, 720th day, she saw heat lightning. When she had been told its name, she ran from one member of the family to another, saying earnestly, "Ruth saw flash lightning!"—"What did it look like?" she was asked. She shut her eyes as tightly as she could, and clinched her hands, saying, "Looked like just this way."

2. Movements of Lids.

I watched for the various asymmetric movements mentioned by Preyer, but no one about my niece was able to see as much asymmetry as in the case of his child. The lids were never but twice — on the 53d and 54th days — unequally raised to any extent that was perceptible without close scrutiny; both times were immediately after sleep.

On the 27th day her mother saw the lids raised with a downward look, just as noted by Preyer; and for some days after I saw this repeatedly myself, the sclerotic coat visible above the iris; I have no note of it except when she was in the bath, at which time the movements of her eyes were more active and more asymmetric. After the first month this look was rare, noted not at all in the second month, but several times at the end of the third and during the first half of the fourth, 90th to 105th days; so far as my notes indicate, it was always when the baby was being bathed, or wiped after her bath.

On the 104th day I first saw the brow wrinkled in looking upward; but for some days before, the skin between the forehead and fontanel had wrinkled with this look.

Contrary to Preyer's observation, she nursed from the first with eyes closed; after the 47th day, the lids were dropped oftener than entirely closed; I never but twice saw them open, and on one of these occasions it was because she caught sight of a candle as she was placed at the breast, and stared at it awhile before closing her eyes. I have since watched and inquired about several other babies, and found none that nursed with open eyes.

We were not able to observe any regular relation between widely opened eyes and pleasure in the case of my niece. Up to the fifth week her eyes at no time opened as widely as they did from that date; and it was not till the seventh week that I noticed them stretched widely, in the bath and while wiped, in connection with signs of satisfaction, — panting, and movements of limbs. She had then had instead for a couple of weeks a habit when bathed, or undressed by the fire, of fixing her eyes on her mother's face and turning her head away, so as to give a curious sidelong look,

which somehow had an unmistakable effect of high satisfaction. Up to the 45th day the look appeared only when she was bathed or undressed; on that day once when lying dressed, but very comfortable, on the lounge; after this I have no more note of it; it seems to have disappeared as an expression of satisfaction with the appearance of the wide-eyed staring, — which, however, never became a marked habit. I never saw her shut her eyes under discomfort, as having nose or ears washed; she either submitted indifferently, or expressed discomfort by wriggling and uttering little sounds. The fallen lids when nursing accompanied an expression of great content. In fear and in surprise her eyes were opened wide.

The first time that she winked at having a head suddenly thrust close to her eyes was on the 56th day, when the wink followed slowly but regularly, six times without a failure. It had been tried in vain almost daily for weeks before. I have noted several instances of winking at sudden sounds. 139th day when someone snapped his teeth together several times a foot or so from her face, she winked every time, and looked much surprised; 167th day I was told of her winking at the wind; 185th day, banging her rattle down in high glee, she winked at every blow. As a general thing she was not easily startled, and I saw very few noticeable instances of winking. I did not watch for them carefully, however, knowing that one should be a physiologist to observe intelligently the reflex actions.

3. **Movements of Balls.**

These also were generally symmetric; but occasionally in the first and second months, especially the first, there was a distinct crossing, and several times in the third month a slight one. When in the bath she rolled her eyes about more irregularly than at any other time. Notwithstanding that the movements of her eyes were generally in unison, there was about them always in the first two months a certain appearance of convergence, — as in the case of all babies of this age I have noticed; and this look was occasionally seen as late as the ninth month, when my last note of it occurs, 249th day.

Fixation.

I have noted her staring at faces especially, among light surfaces, during the third week; this increased in the fourth. On the 25th day, as she lay wide awake and comfortable in her grandmother's lap, staring thus at her face, with an appearance of attention, I leaned down close beside, so as to bring my face into the field of vision. The baby turned her eyes (not head) and gazed at my face with the same appearance of attention, even *effort*, in slight tension of brows and lips; then back to her grandmother's face, again to mine, so several times. This seems clearly Preyer's "second stage" of fixation. At last she seemed to become aware of my red gown, or the lamplight striking the shoulder, and not only moved her eyes, but threw her head far back to look at my shoulder, with a new expression, a sort of dim interest, or eagerness.

The "third stage," the following of an object in motion, I did not fix satisfactorily. The nurse, who was a careful observer, said that the baby followed the motion of her hand on the 9th day. I could not satisfy myself that she did, even as late as the fifth week; her eyes seemed sometimes briefly to follow the moving hand, but she was so active, moving head and eyes constantly, that I could not trust the appearance; her mother was satisfied that she followed the motion. On the 33d day I tried a candle, and her eyes followed it unmistakably, rolling as far as they could, and then the head was turned to follow still farther. Had I tried a luminous object earlier, I might have found that she could follow it. I find that almost all mothers and nurses place the attainment of power to follow a moving object much earlier than this, usually in the first week.

In this same week, the fifth, she acquired the habit mentioned above of fixing a sidelong look on her mother.

In the fifth week, too, when held up against the shoulder, she would straighten up her head to see around; and thereafter looking about, as if to see what she could see, became more and more her habit, and together with gazing at faces, was her chief occupation till grasping was established. By the tenth week, she would turn her head to look about thus.

On the 40th day, her eyes for the first time followed the movement of a person (who had possibly attracted her attention by a voice and appearance novel to her) as he moved slowly in a semi-circle about the knee where she lay.

At the close of the eighth week, on the 56th day, as she lay on her mother's lap by the fire and I sat close by, she gazed fixedly at my face some fifteen minutes without removing her eyes; indeed, as her mother turned her, in undressing and rubbing, she screwed her head around comically to keep her eyes fixed on me. At last she turned her head clear over and looked at her mother's face. Her mother turned her again toward mine, which she surveyed for a time, then again turned and looked at her mother's; all this with serious attention and effort. Whether she had arrived at a clearer focusing of our faces than before, and was interested in it, or whether this incident was the dawn of recognition of us as separate persons, I cannot tell. It was the same day that she had first responded by a wink to a threat at her eyes.

Soon after, 60th day, I saw some indication that she recognized her mother, for she stopped fretting when hungry on seeing her come in at a door in her line of vision, not three feet away; no certain indication, however, for anyone's entrance might have diverted her attention. The first unmistakable recognition by sight alone was on the 80th day, when she smiled and gave a joyous cry on seeing her grandfather enter. She certainly knew her mother before this, but whether by sight alone, or by the aid of hearing and touch, I could not tell; and though during the next six weeks she showed in many small ways that she distinguished the persons about her one from another, I could not get proof that it was by sight only. For instance, when I came in in the morning and spoke to her, she was accustomed to greet me with smile or cry; on the 167th day, I came in without speaking, to see if she would make the same demonstration; she looked at me seriously, then fixed her gaze on a lamp I held; I set it away, then came and spoke to her; but she made no response till I bent down, then caught my face familiarly in her hands. By such vague behavior, she defeated efforts to establish certainly her discrimination of our faces until long after I was sure that she did know them. Late in the fourth month, she noticed any change in our appearance wrought by headgear or

wraps, with surprised looks at the articles, however unobtrusive in form and color; and on the 160th day, though staring with the usual surprise at our hats, she paid no attention to that of a stranger who had come in with us. As she would answer a smile by laughter and movements; once laughed at a grimace (130th day); in the sixteenth week, when especially interested in an uncle, would smile when he looked at her; and (*e. g.*, 119th day) watched our lips, even looking from her mother's lips to mine, when interested in a sound we made,—it seems certain that by the fourth month at least, our faces must have been clear to her. In the sixth month, being separated from her mother when hungry, she cried hard for her, watching at every turn in a corridor and every door passed through, and was instantly comforted at sight of her; but I had no doubt she had recognized her perfectly weeks before.

The 141st day, she seemed to recognize her grandmother through the window; but the day before, I was told, this slight obstacle had prevented recognition till her grandmother raised the sash and smiled at her alternately with and without its intervention; and on the 143d day she seemed to find me unfamiliar seen through the pane. On the 158th day she held out her arms to me when she was some ten feet from the closed window through which I looked at her; and in the eighth month, 228th day, she recognized her grandfather's head some thirty feet away, through *two* closed windows. Yet as late as the twentieth month, being in a company of strangers in a room not strongly lighted, she took them for neighbors, calling one and another by the names of persons to whom they bore slight resemblance.

Once in the fifth month, 136th day, I called to her, the back of a willow chair being between us. She looked each side of the chair with growing surprise, and at last directly at the back several times, but without seeing me, though it was easy to see through the open work: either she could not recognize my face crossed by the willow rods, or did not understand carrying her look past the obstacle; her face was somewhat troubled as well as amazed, jaw dropped and brows lifted.¹

¹ Professor Joseph Le Conte reminds me that if she looked *at* the chair back she saw my face doubled.

The objects early noticed by her, other than bright surfaces or shining points, and faces, were (if I pass by the lighted surfaces of color, 25th and 37th days): 42d day, bunch of yellow flowers; 56th and 57th, knot of red ribbon; 62d, red and yellow strips; 68th, bunch of bright sachets, shadows of chandelier quivering on the ceiling; 80th day, she became silent when fretting, and watched attentively the leaves of a small notebook fluttered before her, moving hands and feet with interest; 87th, an eyeglass dangled from a string. Up to nearly three months old, therefore, she had not, so far as I saw, in spite of her looking about, really looked *at* any special objects that were not lighted up, colored, or in motion. On the 87th day, however, she twice looked seriously, but without appearance of curiosity, at a rattle in her hand; after this, fixing her eyes with attention on various objects became common. Bright or colored ones did not seem to keep their ascendancy after the third or at all events the fourth month, nor moving ones whose motion was not followed, though they continued to attract: 105th day she watched the moving landscape from the car window for a half hour with pleasure; 130th day watched the windmill; 162d, noticed especially of all the sights in the city, passing cable cars, walls of the elevator as it rose and sank, and trees blowing outside a window.

I had noted especially that up to the incident of the rattle on the 87th day she had never looked at anything held in her hands, even when she showed interest in having it there; and thereafter she looked at such objects rarely and with slight attention, till grasping was fully established. This process was gradually acquired during the whole of the fourth month; I did not see her fix an object with her eye and then try to reach it before the 113th day. There was a constant progress in co-ordination of eye and touch in learning this. I shall hope hereafter to give details of this under the subject of Grasping. I never but once saw her hold up an object, — her rattle, as she lay on her back in the sun, 134th day, — and inspect it long and carefully; nor did she ever at any time look with attention at her own hands, as some babies do; not even when, 97th day, she was pounding her fist down hard on the table, did she look at it.

As to the *size* of objects of which she had clear enough vision

to try to grasp them: the rattle, an unusually small one, was the smallest I have note of until the latter part of the fifth month, when she would reach for, seize, and play with the curtain cord, and put the knot into her mouth; in the sixth month, 158th day, she tried to catch flies on the pane; 168th, tried to reach a fragment of red sugar on the floor, scarcely one-fourth inch in diameter, and thereafter several times bits of paper, petals, etc., of similar size. In the sixth month also a few other very small objects were grasped, as a rubber ring, of the smallest size used for papers, and strings were favorites. In the latter part of the eighth month, the smallest scraps and shreds on the carpet, down to pin-head size, occupied her a good deal; once a single hair.

I have mentioned that she followed the motion of a person in the second month. I did not myself see any advance in this power in the third, but was told that on the 84th day she watched her grandfather out of the room when he quitted her after a play, kept her eyes on him as he stood in the next room a few seconds, and gave a joyous crow when he turned to come back. By the fifteenth week, she followed moving persons constantly with her eyes, and thereafter my notes of it are frequent. By the nineteenth week she was fond of following them through long processes, as setting the table, without a deviation of attention. By the twenty-fourth, she would sometimes follow the movements of hands: *e. g.*, she would watch closely the motion of forks and spoons to our lips at table.

Meanwhile, in the fourth month, 119th day, she once followed a bunch of sachets with her eyes as it was swung back and forth before her for many minutes. In the nineteenth week, 129th day, she once looked after a napkin ring on dropping it; but it was a solitary occurrence, and she did not begin to look at all intelligently after falling objects till the next month, the 160th day; she could in the nineteenth week find her rattle if she dropped it on the tray of the high-chair immediately before her, but not in her lap or on the floor. After the 160th day for about a week, she dropped articles on purpose to watch them, sometimes for as long as anyone would pick them up, or would hold her out to pick them up herself. She had another period of earnest and persistent experiment in this direction in the eighth month.

The 136th day she watched steam from the kettle, without trying to follow its motion; 158th, trying to catch flies on the pane, looked up after them when they went too high for her; 162d, watched objects from the train window, and would now and then look back to keep her eyes on one as the train moved.

Early in the seventh month she would follow the flight of the pigeons as they flew up near by; no smaller bird till the 230th day I was told she followed a blackbird; about the middle of the tenth month she began to follow the flight of small birds if her attention was drawn by their twittering, or if she chanced to be looking as they flew up: in the eleventh month, 321st day and thereafter, she followed the flight of large, slow butterflies.

As to the *distance* at which she seemed to see things, I have mentioned her watching her grandfather into the next room, some fifteen feet away, on the 84th day; by the fifteenth week she often noticed us and smiled at us across the room; in the seventeenth (115th day), at her mother once in the next room, fifteen or twenty feet away. I thought in the seventeenth week that she showed a special interest and a sort of curiosity over faces at that distance, and wondered if they looked to her conspicuously *smaller*.

The objects that she would watch through the window in the fifth month were usually within fifty feet of the window. The 156th day I was told she watched me as I stepped into a phaeton and until it passed out of sight behind trees, perhaps one hundred feet away. The same day she watched her mother go some twenty yards away to gather flowers. She never reached arms to seize objects much out of her reach,— never more than say three feet away; if one held arms to her from a distance, however, she would respond, laughing; but this, I think, was merely a gesture, without expectation that we would take her from that distance. In the sixth month, she had no difficulty in recognizing our faces at upper windows. On the 175th day she seemed to be watching a team passing about one hundred feet from the window, she herself being some eight or ten feet from the window, in the room. Early in the ninth month, 279th day, she noticed through a closed window a team some seventy-five feet away; 296th day she recognized my face at an upper window when she was about forty feet from the house, but she also

heard my voice. On the 292d she called for a red rose seen at a distance of perhaps eighty feet through trees and bushes, and kept her eye on it all the way as she was carried to it, jubilating as she saw she was to have it.

I saw no indication in the first year that she ever looked really *away*, into the distance; but the day she was a year old she proved to know the moon, pointed out to her by someone three days earlier. After this she was taken to the window to see it, or outdoors when the weather was warm enough, every full moon until the days grew too long, about six months (as her birth was on October 6). In the fifty-fifth week, her attention was called to a star, and thereafter she was interested in looking for stars also, and would sometimes detect them very quickly and point, crying "Tar." She took great pleasure in looking at moon and stars, and would greet them with a shout of joy.

Meanwhile, in the latter part of the thirteenth month, she began to recognize cows a half-mile away on the hills, not, however, from her knowledge of the appearance of a cow near by, but because they had been pointed out to her a little while before from a car window.

It was late in the eighteenth month, 542d day, before she said anything that showed an idea that the moon could be reached; she then asked, "Ea'? Woo?"—"O, no, Ruth can't eat the moon." "Man?"—"No, men cannot eat it." "Laly?"—"No, nor ladies." "Owgu?"—"No, aunty cannot; it is up in the sky; it is too far to reach." The words, "too far," and "reach," were quite familiar to her before, in connection with things hung just beyond her grasp, and the like, but this seemed to be her first idea of great distance, and she was interested and curious; she stretched out her arm and cried, "Rea! Far!" over and over. A week later she began asking me to get the moon. When told that we could not reach it, she desired to be shown that we could not, and wished each of us in turn to stretch an arm to show her how far our best efforts fell short. When we went into the house, and she was told to tell grandma what she had seen, she answered, as usual, "Moon," then added, "Far!" Next morning at breakfast, hearing us speak of her wish to get the moon, she turned in her chair, and reached her hand prettily toward the ceiling, looking up as if far away, and crying, "Far!" This she did several times.

Up to the fourth six months, she certainly did not distinguish at as great a distance as we; we are all rather far-sighted, however. From the seventy-second to the seventy-fifth week she repeatedly misnamed men or boys at perhaps twenty yards distance; the less familiar person being almost always called by the name of the one better known. Any man in farmer's clothes at that distance would be called by the name of her uncle; any boy of eight or ten, "Ray;" any child under four or five, "Harrison." As the person mistaken came nearer, if he was known to her, she would correct herself; if a stranger, she would say, "Man!" or "Boy!" or "Baby!"—always with an air slightly surprised and crestfallen. She once mistook a strange young girl at a distance for one slightly known to her; but never made any error about women she knew at all well, perhaps because their garments made them recognizable farther away, perhaps because she really knew them better than the men of the family. On the 590th day, again, seeing her uncle (a tall man) about a hundred feet away, she called him by the name of a half-grown Portuguese boy, who worked about the place and was well known by sight to her; there was no resemblance in face, and none perceptible to us in gait or bearing. As he came nearer, she became doubtful, but did not call her uncle's name positively till he was within fifty feet. She looked at him very intently then, and later in the same day recognized him at once when seen more than one hundred feet away. This goes to show that her mistakes were due not so much to defect in distant vision as to failure to observe and fix in mind those *general* aspects by which we recognize persons at a distance. In this case, a chief element of error was failure to estimate *size*; but not in the earlier instances. I never noticed an error in distant recognition afterward. The 626th day, however, seeing her grandfather occupied some twenty-five feet away, she said he was "eating," though he was in fact counting money, every outline and motion clearly defined against a window; and she could not make out what he was doing till she had come close to him. On the 645th day, again, I was told that she mistook a white cow on a distant hillside for a goat, — the estimate of size here again evidently at fault; and quite recently, late in the third year, she called horses far away on the hills pigs.¹

¹The following notes, from records kept by Mrs. Eleanor Sharpe, of San

5. Direction.

On the 87th day I first saw her look *for* something: she was much interested in a guest, a lively girl, and not only followed her movements, but would look for her when out of sight (89th day). 92d day, just before three months old, she turned her head and looked with an appearance of intention in the direction of a sound heard a few seconds before. I had been told of her doing this several times in this and the preceding week, once at the snapping of the fire; but could not get her to look by any sound I could make, though she would show attention by her manner. Thereafter she would sometimes turn her head to look for the source of a sound, but never at all regularly. On the 122d day she leaned first to one side then the other, to look around the chair back with quick, eager turns of her head, to see her uncle playing; when I took her to his side, she watched his fingers eagerly, and when he began to sing, gazed alternately up to his face and down at his fingers, throwing her head far back to look up, and alternating her gaze about every five seconds during the entire stanza.

Her looking after objects dropped has been mentioned above. 132d day she looked repeatedly to see what touched the back of her head, when she had bent it back till it touched the floor.

Francisco, and by Mrs. Mabel Beatty (B. L., University of California), and kindly placed at my disposal, bear on the subjects of Fixation and Direction:—

I. Before the child was a month old, he turned eyes and head to follow a lighted car down the street.

In the third month he was interested in watching his brothers at their play.

In the fourth month, 106th day, he did not know his nurse when she was dressed to go out, and was on the point of crying until she spoke to him.

In the tenth month, when in his bath, he would try to grasp the sponge or the stream of water from it, if held within reach, but never if much beyond reach.

II. In the third month the child seemed to be studying faces.

In first learning to grasp, in the 17th and 18th weeks, he did not always hit accurately.

In the 23d week, he looked *for* a cable car in the proper direction.

In the sixth month he began to follow the direction of a pointing finger; when told to look at anything, he would first look to see the pointing finger, then fix the object; yet as late as the eighth month he would sometimes look only at the finger. In the tenth month he began to point himself, indicating the direction in which he wished to go.

On the 133d day occurred a rather striking incident. I had been holding her, but gave her to her mother to put to sleep; she was no sooner settled in her mother's lap than she began to turn her head to watch me; and when her mother turned to prevent this, she would screw her head over her shoulder; so I rose from my seat to the right of her, and crossing toward the left, sat down concealed. She did not follow the motion, but after a few seconds raised her head from her mother's arm, and screwing it about, searched the farthest *left*-hand quarter of the room, and it was some time before she would be contented without seeing me there. She seemed able to infer from the direction in which I had passed from her field of vision that I was to be looked for somewhere on an extension of that line. Yet she did not, as a rule, show a sense of direction nearly so good: see Interpretation, below.

Her earliest ability to direct her look, except when it was drawn along by something it was following, was when guided by a continuous sound close by; from the fifth to the seventh week, she had stared into the face of a person striking the piano, as if the sound came thence; on the 45th day, she turned once and looked at the keys. On the 57th day she began to watch the keys.

In the twenty-third week she would look around her on the floor for playthings she had dropped.

The 165th day I looked at her and called, over the top of a tall screen, and withdrew my head and reappeared several times. She would watch the spot in the interval,—a few seconds. She had no difficulty in looking directly at the place whence the voice came, though it was so high I had to stand on tiptoe on a chair, and no one had ever spoken to her thence. Three days later I tried it again, appearing at different spots, several feet apart, along the long screen. She had no trouble in looking at me at once, though she became a little confused as to which spot to watch for my reappearance, and if I did not appear promptly at the last one, would go back and watch the first. About the same date, I called to her from an upper window; she looked assiduously, but never high enough, and grew troubled and surprised; her mother tried to make her follow her pointing hand, but she did not get the idea of following on in the direction indicated, farther than the hand. At last her grandmother rustled a paper sharply, which somehow drew her eyes up to the window, twelve or thirteen feet above her. In

one or two other trials we found that a sufficiently sharp or striking sound somehow enabled her to locate the source. When she discovered us, she apparently knew us at once, smiling and moving her arms. Although ordinarily so accurate in locating a voice, occasionally she would look at the wrong person when two were close together.

I noticed in this week that her attention could be drawn in a given direction by motioning with the hand; but even through the seventh month this could be done but imperfectly, as she was apt to watch the hand or face, instead of looking on in the direction indicated.

The 177th day (near the end of the sixth month) disturbed a little while nursing, she sat up and looked around, and caught sight of a knot of cords on an ottoman close by, and reached for it. Her mother set her *on* it. She looked all about for it, leaning this way and that to look, and when taken back to be nursed kept stopping and looking for it at intervals. Her surprise at its disappearance and confusion as to its direction were very quaint. Nearly two weeks before I had observed that she would remember, even after nursing some moments, to look back to where she had noticed a bit of paper or the like on the floor.

By the end of the sixth month, she would usually turn and look very intelligently into the face of anyone calling her.

In the ninth month she became able to follow a pointing finger easily and correctly. Early in the tenth (281st day) she did it so well as instantly to locate a small black kitten's head thrust from a wood pile some fifteen or twenty feet away.

By the middle of the second year she seemed to have a very clear sense of direction, judging from the precision with which she could go to any desired spot about the house and garden; but I suspect this was largely a memory of objects that served as guides. In the 103d week she could not find the lounge in the dark, in a room perfectly familiar.

The 623d day she was quite puzzled by a difficulty of direction. She had discovered the trick of looking between her legs, and, wishing to look at her mother in this manner, turned her *face* toward her and stooped. Surprised at seeing objects in the opposite direction, she tried it over again, with the same result, and her mother then helped her out.

Color.

On the twenty-third day I tried in vain to get any attention from the baby to a red silk kerchief, brilliantly lighted by the sun. But on the 25th day, in the evening, having caught sight of my dark red gown, barely within her field of vision, in strong lamp-light, she threw her head far back to see it, with an expression of interest, such as she had never had before. Yet on the 37th day she stared as earnestly at a dark *blue* sack I wore, where the high light from a window struck my shoulder. Neither of these garments was of glossy material, both soft wool; yet I thought it probable that the high light and not the color was in both cases the attraction. After this her eyes dwelt a good deal, for a few days, on the red gown, even when no direct light was on it, but there was no demonstration of interest. Later in the same week, the sixth, on the 42d day, her eyes followed persistently a bunch of yellow chrysanthemums, and returned constantly to dwell on another bunch pinned on my breast. I procured a bunch of bright red geraniums of similar size and form, which was followed when I persistently attracted her attention, but less readily; a bunch of pink geraniums scarcely at all; but fatigue counted for something in this, and when I returned to the chrysanthemums, she was not as intent as at first.

At the beginning of the ninth week, 57th day, she once looked fixedly at my red ribbon, and her mother told me that the day before the baby had caught sight of a red bow at her neck, stopped nursing to stare at it, and would not go on till it was put out of sight.

The first day of the third month, 62d day, I tried to find her preference by suspending two long strips, one red and one yellow, before her, at equal distance to right and left, so that she would have to turn her head slightly to look at either. She gazed at first one and then the other with some interest, then neglected both for the bright button heads in the canopy to which they were fastened. The next day I found her, after a long sleep and in high good humor, making demonstrations of pleasure over them, with arms moving, smiles, and murmurs, but unfortunately, someone had knotted them together, so she saw both at once. On the 68th

day, also, I was told of her making joyous demonstrations over a bunch of bright sachets hung from the canopy (not in motion). These were her first signs of *joy* in color; but she was not in any respect as demonstrative at this stage as Preyer's child.

During the fourth month I noted several instances of attentive gazing at bright-colored objects — a pink and white fan, yellow daffodils, a red shawl, *e. g.*; the 120th day she stared with raised brows and look of surprise at the flowers, which lay on the table, and the shawl, which lay on a chair, as if she recognized the color as unfamiliar in those places. From this time to about the middle of the sixth month, the daffodils were about the house in great quantities, and possibly helped to develop her perception of yellow. On the 132d day — early in the fifth month — I was told she stopped crying to look at a jar of them, and from that time I note her invariable interest in them; when she came to seize, her arms were always stretched out for them, and the first time she cried with the least persistence at denial was for them; a jar of them in the sun called out excited movements. She had never shown so uniform interest in any object. But with this exception, I have no notes of consequence of color interest during the fifth month till near the end; a few colored objects were noticed, but no more than uncolored ones. (It is worth observing, however, that up to the end of the third month colored objects attracted far more attention than uncolored.) Except for the daffodils, hard, bright objects were preferred to soft, colored ones to play with; a silver-nickel call-bell especially, a small steel bell, napkin rings, etc. Near the end of the month, 146th day, she first tried to pull off my neck ribbon, a yellow one; she had not noticed the red and pink ones I had been wearing, and next day did not notice a red one. Yet the 141st day she took but little interest in a yellow Indian basket, about the size and color of a jar of daffodils that usually stood in the same place; and on the same day showed no interest in brown and yellow figures on the piano cover, but tried to seize red ones on the table cover, while on the 147th, she reached arms for a jar of pink and purple hyacinths and one of daffodils with equal interest.

Throughout the sixth month one of the most interesting objects to her was a colored picture of daffodils, which hung low on the wall. I first note her reaching for this, among other objects, on the

second day of the month (153d); and from this time to the last week of the month my notes record an *invariable* interest in it; she would be diverted by it even when crying. No picture at this time was recognized as a representation, and her liking must have been due either to the color, or to the fact that it was the only bright picture low enough on the wall for her to touch and look closely at. On the day that she first noticed it, she reached also for the yellow Indian basket; but so too for any flowers, and for objects not colored,—curtain cords, books, newspapers. On the 154th she reached for a colored linen book among all her toys, and spent some time dabbling at the pictures and trying to pick them up; and again, cared for none of her toys till a red and yellow celluloid ball was held to the light, — this she reached for with apparent excitement; three days later I note again her interest in the ball, but after this she ceased to care for it much.

A few other colored objects were among those that she wished to have or liked to play with in the sixth month, especially a little bright blue bottle. We thought her more certain to grasp at our ribbons, and with more desire, if they were yellow, and once, when denied a yellow one, she remembered it with a whine for some seconds, but she would snatch even at white ones, and she plucked at my red gown (149th day). The 181st day, just before the end of the sixth month, I tried to test her by dangling ribbons of various colors before her; but she grasped always the one that received the strongest light from the window; and when we put them in equal light, turned from one to another with equal joy.

From the beginning of the sixth month to the end of the year, flowers were perhaps her favorite playthings. I took much note of her color preferences among them. The following were the most marked indications:—

Sixth month, 156th day, regarded a patch of orange-colored marigolds (to which her attention was drawn) very earnestly, with motions of her hands toward them. When wheeled close to a hedge of Japanese quince, all cherry red, showed more excitement, leaning out with outstretched arms and babbling to it. This hedge continued to excite her as long as it remained in flower,—she never passed it without leaning out and reaching for it, or babbling to it. It made a very *large* expanse of color, however, larger than any

other she saw, which may have had as much to do with her interest as the fact that it was red.

172d day, showed unusual excitement and desire over some yellow buttercups in her mother's hat; would not be pacified without them, and when her mother had left the room to put them out of sight, the baby looked for them on her reappearance, and expressed discontent on seeing them gone.

Seventh month, 202d day, cries of pleasure at a clump of yellow oxalis (to which, however, her attention was called).

Ninth month, late, decided preference appeared for the orange-colored marigolds.

Tenth, preference for marigolds lasts through the month, — she reaches for them past scarlet geraniums. Toward the end of the month, however, she would beg for other orange-colored flowers, for golden-rod, and for red flowers, also for oleanders and pink roses, even pale pink. White roses she became very desirous of about the middle of the month; but their contrast with the dark green leaves made them quite conspicuous on the vine. 292d day for the first time she showed pleasure and desire over a blue flower, a large and showy African lily; but never again in the first year.

Eleventh month, pink roses seemed at first her favorites; but after the middle of the month, her preferences ceased to be fixed, — she would want now pink and red flowers, rejecting large yellow primroses, and later the same day put everything aside for the marigolds again. Of course other things than color enter into these choices, chiefly convenience of form, texture, and taste for handling and mouthing; the advantage in these respects was with the roses. 321st day noticed "heliotrope-colored" flowers on a gown, and thereafter was interested in that gown and its flowers.

Other color indications in the second six months: —

Seventh month, 201st day, did not notice the substitution of a white rubber nipple for a black one, on which she was very dependent in going to sleep.

Ninth month, last week, did not notice especially gilt braid and ornaments on a yachting gown, nor brass fittings on the yacht.

Tenth month, 269th day, tested her again with ribbons of bright, clear tones, and the results seemed to show preference for yellow

and orange, next red; blue and pink were entirely neglected.¹ I had no green ribbon.

In the middle of the eleventh month I tried again; preference for orange and scarlet, but not strong preference. Of five little books she was fond of playing with, which were dull shades of cream, yellow, brown, and green, she preferred the green; green leaves, however, never seemed to interest her. She was habitually interested in large yellow butterflies at this time. On the 321st day, I was told, she refused to have on her white sunbonnet, insisting on her pink one.

Late in the twelfth month, 352d day, she distinctly preferred two bright blue books to a bright red and a bright yellow one on the same shelf.

My general impression of her color liking this year, both at the time and afterward in analyzing my notes, was that it did not play a large part in her interests. The small number of notes of color interest, considering how closely I gleaned, is noticeable. It was also unaccountably variable; a surface of bright color would occasionally bring out signs of great pleasure, and at other times was passed with indifference, when no condition was perceptibly altered. But this variability was more or less characteristic of all her interests.

It was also the impression of those who watched her, even more decidedly than the notes indicate, that yellow attracted her most, then orange and red, and pink, while blue and violet were scarcely noticed, green still less. But we were also satisfied that a bright surface of the cold colors was preferred to a dull one of the warm colors.

During the second year, the child's color sense was mainly observable in connection with the learning of color names.

In the first part of the thirteenth month it was a favorite occupation to turn over the leaves of a picture book, pointing to separate objects in the pictures, and asking with an interrogative sound to have them named; in this way it chanced that she was repeat-

¹Mrs. Sharpe first tried her boy with colors in the seventh month, 219th day. He would drop red, blue, or green ribbons to grasp either scarlet or gray, but reached for the scarlet in preference to the gray every time.

edly told, "That is the *white* kitty," "the *brown* kitty." When asked, however, "Where is the white kitty?" she could not tell, though in the habit of pointing out objects in the pictures when asked. The word *white* evidently added nothing to the idea of *kitty*. By the end of the month she did know which was the "white kitty" in the particular picture, but not which kittens were white in other pictures; she had simply attached "white-kitty" as a name to that one, easily recognized by position. Meantime, on three separate days in the fifty-fifth week, after having had *red flower* and *white flower*, *red string* and *white string* carefully named to her, (*string* and *flower*, like *kitty*, being already well understood,) she several times selected the color called for, though she also failed several times in the case of the "strings" (bits of zephyr). My impression was hardly that she fixed the difference in name by the difference in color, but rather that she managed to keep distinct for a few seconds, in spite of changes of position, the objects each as a whole.

On the last day of the month, the 396th, I named over to her the colors of my books as they stood on the shelves; this interested her very much, and she urged me to continue, pointing with an asking sound. In the fourteenth month likewise, when someone named to her the colors of the roses in a panel picture, she was pleased, and would afterward (fifty-eighth week) ask, pointing to one rose after another, to be told, "That is a pink rose; a yellow rose; a red rose; a white rose." I could not see, however, throughout the month, that she remembered these names at all, or knew what they meant. I tried her several times, giving her always the color adjective in connection with the perfectly familiar nouns, *book*, *rose*, *ribbon*; but if the distinction was caught, it was with difficulty, and for but a few seconds, — a marked contrast to the ease with which she picked up and held the names of objects. Yet on the 416th day she put her finger on an ink spot, saying, "Dark!" — a word hitherto used of a dark room only; showing some ability to abstract the idea of a quality, a color quality at that, from one object and apply it to another.

Toward the end of the fifteenth month I made a good many efforts to have her distinguish between the black, white, red, and blue stripes of an afghan, but in vain. Beyond these few experiments, and the incidental use of color words, like others, in talking with her, nothing was done to hasten her use of them.

Yet near the end of the sixteenth month she was suddenly found in possession of "red." On the 481st day I was told that she had pointed to a red book, saying, "Wě! wě!" and was not satisfied till her mother asked, "Does baby mean red?" The next day, as she played by me on a red mahogany sofa, she put her hand on the wood, saying, "Wě!" persistently; at last I asked, "Does Ruth mean red?" and she assented. "Show aunty more red," I said, and after some hesitation, as the request was urged, she pointed out the red carpet, then the red table cover, without any help.

Later in the same day I held her before a colored picture of flowers on the wall, and asked her, "Where is some red?" and she put her finger on some clear red nasturtiums. Again, after a considerable interval, I showed her red, yellow, and white ribbons, and told her to take the red; she did so two or three times, after slight hesitation. Then I placed a number of books, bright red, yellow, blue, and green, before her, and told her to find the red, which she did several times. I then took her to the picture of roses, but here she was confused between red and pink, and then once even pointed to white.

It was strange that the mahogany, which, though quite a pure red, was so dark that even persons fairly versed in colors might have called it brown, should have been almost the first thing to which she applied the word; we had certainly never named any such shade to her as red.

This incident proved one of the instances that I often noticed of a sort of *anticipation* of a power not really possessed till later. Two days after she was not able to point out the red book on a shelf, and seized yellow, green, and brown with confidence instead. I then dropped the experiment, and she showed no farther thought of naming colors for more than a month.

On the last day of the seventeenth month (517th) hearing me say something of a red pencil, she began looking at two she held in her hand, first one and then the other, asking, "Red? red?"—"Which is the red one?" I asked. She offered the black one inquiringly, and when I said, "That is n't red," withdrew it and offered the other, which was red, with confidence, crying, "Red." I now told her to point out the red in my gown; at first she dabbed at it anywhere, saying, "Red," then more carefully pointed out the red stripe. A disposition instantly to answer any question, right or

wrong, doubtless caused many of her errors, first and last. Soon after, she pulled a red book from a shelf, crying, "Red!"

A week later, in the eighteenth month, I asked her, as she was playing with some books, "What color?" She said, "Red" (Wě) then "Lě," without fixing on a book. With some trouble, we satisfied ourselves that "lě" meant yellow. She then added, "Boo," pointing first hesitantly to a red book, then positively to a blue one. She seemed so clear and triumphant about the blue, and had so evidently picked up two new color names without any purposed teaching, that I brought out a set of Prang's color tablets and let her take them. Told to show red, yellow, and blue, she did so correctly often enough to be quite striking; but unfortunately I kept no account, as it happened suddenly, and I was unwilling to lose her streak of interest by going for paper and pencil.

Once, being told to show the blue, she chose out one after another all the blue and violet tablets (four, I think, including light, dark, and green blues), and held up one after another, saying, "Boo," each time; afterward she gathered them together in her own hand and looked at them with interest. It is to be noticed that there were green tablets in the pile, but she seemed to experience not the least difficulty in separating the blue from them. Her interest in the newly named color overshadowed that in red and yellow (aided doubtless by our pleasure), and she was disposed to say, "Boo," hastily for any color.

Besides the discovery of blue, a notable step was that she understood the question, "What color?" — at all events knew when we said "color" *what trait* of the object we wished her to name. Hitherto we had used the converse question, "Show me the red," and had heard it named by her only when she volunteered it.

Three days later I tried her again with the tablets (I had tried her once in the interval, but have only note of "fairly correct answers"); and as I held up red, blue, and yellow, she called each correctly; then, getting a little excited, gave wild answers, confusing red and blue, — the beginning, as it proved, of a thorough confusion.

I did not try the tablets again within the eighteenth month; but on the 536th day, reaching for books, she asked for a blue one as "red." Told that it was not red, she tried "yellow," then "blue;"

then, apparently to be sure of being right this time, called one blue that was in fact red. A couple of hours afterward she pointed to a blue umbrella, calling it red; and when told that it was blue, turned to my red neck ribbon and asserted that it was blue, as also the red lacing cord of my blouse; both were bright red, nearly pure.

From the end of the fourteenth month she had used the word black, confusing it more or less with dirty, perhaps because she often saw hands soiled with taking up coal, or soiled her own on the coal hod; she had first picked up the word in hearing it said of ink spots. She now, in the eighteenth month, nearly dropped its use to mean dirty, and in the seventy-sixth week would point out the black stripes on the afghan, saying, "Bă!" 533d day, asked, "What color are your stockings?" would answer, "Black." The recognition of blackness (including any dark gray, soiled aspect) as a quality was really earlier and more spontaneous than that of color proper.

As to her color *preferences* during the six months, red seemed at first favored. In the thirteenth month, 375th day, she discovered and watched with interest a dull red sunset; 377th, took marked interest in my yellow ribbon, and chose her buff sunbonnet rather than her pink; but 382d, and for some days, was very desirous of an aunt's scarlet knitting. In the fourteenth month, 416th day, playing on a pile of fresh cobs, she carefully picked out the red ones; and on the 426th day she distinctly preferred red books on my shelves. Again, in the fifteenth month, 444th day, she chose out the red books; on the 450th, seeing her pink dress under a pile of others, white and dark blue, she drew it out and asked by motions to have it put on, and clung to it for some time.

The next quarter, however, outside of the interest in *naming* red and blue, yellow seemed the favorite. During the seventeenth month she was eagerly interested in daffodils, as she had been the year before; in the eighteenth, yellow oxalis was the flower constantly sought, though in this case I thought the long, flexible stems, which she enjoyed pulling and handling, the chief attraction. Orange-colored eschscholtzias and yellow mustards were next favorites after the oxalis; but she did not care for marigolds, nearly the same color as the poppies. At times, for some days in both seventeenth and eighteenth months, her chief desire outdoors was to run

to a mallow bush and pick off the white and scarlet seed vessels; she did not care much for them when picked, and when her hands were full would drop them and seek more. Roses always pleased her, and in the latter part of the month, lilacs; once I saw her interested in some red-purple ixias and red and yellow dwarf fuchsias. The first time a blue flower was noticed in the second year was the 518th day, when she ran up to a periwinkle, crying, "Baby, fowa!" (a flower for baby); she did not care to pick it, however, nor pay any farther attention to periwinkles. The 536th day, she was much pleased with a blue-purple grass-flower.

Late in the eighteenth month I saw several instances of comparison or association through color. On the 536th day, seeing a large piece of red cloth, she cried insistently, "Laly!" (lady); the only explanation was that a lady in a red dress had been at the house a month before. Next day, looking at a flower catalogue, she called a narcissus a rose. "But this is a *yellow* flower," I said idly, not expecting her to understand; but she cried, "Dă!" (Then it is a daffodil). Yet the daffodils had been gone for two weeks. The length of the memory is more surprising in the first instance, but the second is more curious in the *word's* being the medium of memory; for the resemblance of the narcissus in the picture to the daffodils was not close. A third instance was on the 544th day, when she recognized as a lemon one that by freak was shaped like an orange; it must have been by the paler color that she knew them apart.

In the nineteenth month came a distinct ability to name colors, and with it a great increase in her interest in color; she often spoke of it, and tried to name the colors she saw. For example, on the 552d day she pulled a piece of blue silk out of a box, and said hesitantly, "Red," then decidedly, "Blue;" then pulled out a red bit and named it correctly. Later, chancing to look up to where a red flag was tucked in the rafters (she was in the garret), she cried, "Red!"

Several times on this day and the next, pointing to white roses, she cried, "Rose! white!" (wo-wo! fwi, or fä!) Questioned, "What color is the rose?" she became confused; but when showed that it

was like her mother's apron, she soon pointed to it and cried, "White!" No one had ever taught her *white* since our futile efforts three months before to see if she could distinguish the "white rose," or "white kitten," but she had heard it used in talk.

On the 557th day she set herself to name over the colors of my books as she pulled them from the shelf and piled them on the bed—red, white, blue. I again had no pencil at hand, but kept rapid count with my fingers, and she did not make more than four mistakes out of fifteen names. She even pointed out on parti-colored books the red and white. This voluntary exercise with the books was repeated from time to time for months.

The progress of my niece's color knowledge thus far differed so strikingly from that of Preyer's child, and she had so evidently passed the stage at which regular tests were begun with him, that I determined to apply these, and an hour or so later tried her with three tablets. The results were not nearly as good as in her spontaneous exercises; but as the correct answers were almost always given with attention and decision, the incorrect ones either inquiringly or hastily and carelessly, the figures understate her real recognition.

To the question, "Where is the red? the blue? the yellow?" she answered: —

—	Right.	Wrong.
Red.....	2	0
Yellow.....	2	1
Blue.....	3	3

To the question, "What color is this?"

—	Right.	Wrong.
Red.....	6	1
Yellow.....	0	3
Blue	0	4

Two days later, naming the colors of books, and choosing white

and red especially, she made no mistakes. Yet with the tablets, to the question, "Where is the red?" etc.: —

—	Right.	Wrong.
Red.....	Would not	attend.
Yellow	1	0
Blue.....	4	0

To the question, "What color?" —

—	Right.	Wrong.
Red	0	3
Yellow.	2	0
Blue.....	1	2

The test that required her to *name* the color thus far proved the more difficult one, yet when she named colors spontaneously the demand on her memory of words was the same.

These two tests were during the eightieth week. I purposed hereafter to give her a test once a week. But after the eighty-first week she began to coax for them, and so had them oftener. The first time, on her mother's suggestion of "the colors," she came to me coaxing, "Red!" Yet red was at the time least cared for, and she often refused to answer regarding it. The second time she came without suggestion, and begged, "Blue-green! blue-green!" Next morning, the moment I entered the breakfast room, she cried, "Red-green! Upstairs! Find!" and recurred to it all breakfast time (574th day). Next day again, hearing something said of "lips getting blue," she broke in, crying, "Get blue! get blue!" and had to be persuaded to finish her lunch. Next day she began to ask for them as "red green-too" (*i. e.*, red and green); 581st day, suddenly, in the midst of quietly eating her potato, broke out with a demand for "Red green-too!" By the end of the twentieth month the usual

form of asking was for "red and green," sometimes with the addition of "— and blue too." No other colors were ever mentioned, except that once in the twenty-first month (618th day) she begged, "Ruth have pink and blue," over and over; finally "pink and blue — and green." Yet at that time pink had never been included among her tablets. During the twenty-first month she was becoming more interested in their forms than in their colors, and began to ask for them under the names of these. On the 637th day: "Ruth see red and green?" — "Not now, dear; Ruth must go to bed." — "Ruth see red and green by and by?" — "Yes." — "And blue?" — "Yes." — "And triangle?" — "Yes." — "And round?" The next day, after she had treated them roughly, and they had been put away: "Have color? Play pretty!" a frequent (though rather valueless) promise under such circumstances, notable in this case as the first instance I have of the general word color, — "cò."

The pleasure taken from the first in the exercises was increased when, at the end of the eighty-second week, I put the tablets into a little box, and allowed her to take out one at a time, naming it. The first time that I did this (575th day), she thus named them over and over for twenty minutes without fatigue. During the whole time the tests were carried on, I never (except on two or three occasions, when I was showing the procedure to others) continued them after her interest flagged. After the close of the nineteenth month she begged daily for them, often several times a day, but sometimes cared little for them when she got them, slapping them about roughly, or putting them into her mouth. Yet she would whimper and beg for them if they were put away. If they were restored, however, after she had once showed fatigue thus, it never proved possible to renew any real interest in them. After the eighty-sixth week it was my custom to let her have them, one after another, upon naming correctly; she thus had, after every lesson, the privilege of playing freely with them, and it was sometimes half an hour before she tired of them. She was also occasionally in the twenty-first month given the whole boxful to play with at will, except that they were withdrawn as soon as she began to play roughly. I watched her play in vain, for the most part, for significant results as to color. Such results as did appear related chiefly to form.

In the eighty-first week, green was added. She was told the

name when first shown the tablet, and never needed to be told again. The result of four tests, eighty-first and eighty-second week, was: —

—	Right.	Wrong.	Question.
Red	4	5	"Where is red?" etc.
Yellow	4	0	
Blue	7	0	
Green	9	0	
Red	1 (1)	11	"What color is this?" and volunteered answers.
Yellow	19	1	
Blue	18 (1)	0	
Green	20	0	
Red	7	17	In all. ¹
Yellow	27	1	
Blue	31	1	
Green	37	1	

In all these tests, when she has given an answer wrong, and at once, without suggestion, corrected it, I have noted it as right, but indicated it by parentheses. When, on the other hand, she has corrected her answer after being asked a second time, I have set it down wrong, though it was often heedlessly made in the first place and readily corrected; the one error noted above as to yellow was of this sort.

It is to be noted especially that not the least confusion between green and blue appeared, now or hereafter. Once, 573d day, having pulled down my books, which I had arranged by color for her benefit, she wished to put them back herself, and put a green book between blue ones. "O no," I said, "put the green book with the other green ones!" and altered its place. After that she three or four times, carefully and after consideration, placed green and blue books in the proper group.

The disposition to interchange the names *red* and *blue*, on the

¹ One test is included here in which I failed to keep separate record for the two forms of question, and the figures therefore do not agree as totals with those in the tables above.

other hand, increased; and practically all the errors in red and blue recorded in the whole period of the tests, were of this nature. Blue was not so much affected by it as red, especially if she saw it *before* the red. On the other hand, I noticed in the eighty-third week that red was answered right without hesitation at first; then as soon as blue had been named she became confused between them. The confusion seemed to occur in the effort to remember; when she called the name without thought, on sight of the color, she had no trouble, but as soon as she began to think about it, she would remember the word blue, and lose confidence. It corroborates this view that when she named the colors of objects about her, which was generally done on impulse without the least thought, she was rarely wrong. The 562d day, *e. g.*, she was greatly interested in a red jacket I wore, crying, "Red! red!" as soon as she saw it, and during the day from time to time, pointed all over it, sleeves, breast, collar, saying, "Red!" So red and blue books, ribbons, handkerchiefs. Yet she did sometimes interchange the words in voluntary comments on color. The first time she saw my books arranged by color she sought the blue group at once, calling it red; the 590th day a red ribbon was at first called blue; the 598th, she asked if the red trimmings of a railway car were blue; and the 612th day asked me earnestly and repeatedly for a "blue pencil," not even perceiving her mistake when I looked about in vain for such a thing before it occurred to me that she meant red.

It seems to me unquestionable that the difficulty was purely a confusion of names. Besides the evidence of incidents already given, the following could hardly have been possible if any confusion of vision existed: On the 573d day, on having the blue tablet shown her, she unhesitatingly called it blue, then instantly pointed to a bookcase where a large bright blue volume was conspicuous, and cried, "Blue!" I then laid a red book before her, and made her understand that I wished her to lay on it a tablet like it; and she did so, selecting the right red, though she had two different red tablets.

The difficulty in naming red seemed to annoy her, and give her a distaste for the color in the tests, which did not perceptibly affect her liking for it under other circumstances. In the eighty-first week, asked, "What is this?" of red, she would give no answer,

but instead point to and name the yellow or green. Once when red was pressed, she decisively picked up the tablets and handed to me, saying, "Way!" (Put away), and when I had several times ignored this request, she took them all, carried them over to the mantel, stood on tiptoe, and tried to put them up, saying, "Way!"

The discrepancies in the *number* of answers given for the different colors are due in part to such preferences and dislikes; but as there were two red, two blue, and two green tablets in the set I used at this time, and but one yellow, the degree in which yellow was sought was greater up to the eighty-sixth week than the figures show. The light and dark green, light and dark blue, were recognized with equal ease, but the two reds were not so easily seen to be the same color, and about the end of the month I laid aside the light red for a time.

The total result of tests for the three weeks of the nineteenth month during which they were carried on, was: —

—	Right.	Wrong.	Question.
Red	9	5	"Where is," etc.
Yellow.....	10	2	
Blue	18	3	
Green	15	0	
Red	10	18	"What color?" and volunteer.
Yellow.....	20	4	
Blue.....	27	10	
Green.....	23	0	
Red	20	24	In all. ¹
Yellow	34	6	
Blue	50	14	
Green.....	51	1	

Meantime the child asked almost daily about the colors whose names she did not yet know. She would point to pink, olive, ecru, purple, asking, "Blue?" "Red?" "White?" — not, I think, that she supposed the colors were these, but that she knew no other way to put the question, as she had not yet the word "color" for her own use. We avoided answering concerning mixed or doubtful colors,

¹ See note, page 38.

but it was impossible to keep her from widening very much her knowledge of each color beyond the typical ones in her tablets. Once on the 574th day, perhaps recalling something I had told her some days before of a baby whose hair was red, she put her hand on my hair, and suggested, "Red?" and was rather disposed to insist till I told her it was brown, which she accepted. She asked the same question about her own and her mother's, which are like mine, brown with no red tinge. This was like the usual formula for asking a new color name, but I was unable to resist the impression in this case that she was struggling with some chaotic association or inference: "Hair, it seems, is a *red* object; this, then, must be red, in spite of appearances."

The 562d day I kept count of one of her voluntary exercises with the books, and found that she named them right (black, white, green, yellow, red) twenty-four times out of thirty.

The 566th day, seeing a lamp extinguished, she cried eagerly, "White lamp! white lamp!" pointing to the porcelain shade, from which the reddish glow was now gone. Her interest in this change of color was the more striking as the lamp had been put out by the breaking of the chimney, amid a good deal of commotion, which she regarded with entire indifference. So repeatedly, "White roses!" White seemed especially to interest her at this time (eighty-first week).

Three tests in the eighty-third week gave:—

—	Right.	Wrong.	Question.
Red	5	2	"Where is," etc.
Yellow	5	0	
Blue	6	0	
Green	5	0	
Red	3	6	"What color?" and volunteer.
Yellow	10	0	
Blue	14 (2)	4	
Green	12 (1)	0	
Red	8	8	In all.
Yellow	15	0	
Blue	22	4	
Green	18	0	

This week she called dark green or dark blue books black, especially by lamplight. She showed some odd confusions in the very colors she was sure of in the tablet tests. The 577th day she called a white book yellow, and the next day called yellow roses red, and told, "O no!" tried "blue." The 562d day she called a white book green, and told, "No," tried "yellow."

She now began to try herself to put "off" colors under the categories she knew, and on the 582d day called an olive book green, and a red-brown one brown. The ability to discern the real color in the olive shade was surprising; and I was unable to tell how she learned to name the brown, for though she knew brown sugar and brown bread very well, and had had brown hair named to her, neither of these browns resembled the color of the book at all nearly. She may have had a wide general idea of brown, or she may have been told this particular shade among her questionings.

Black and white were now added to the tablets. Two tests in the eighty-fourth week gave:—

—	Right.	Wrong.	Question.
Red	3 (2)	1	"Where is the," etc.
Yellow	4	0	
Blue	8	0	
Green	8	0	
Black.....	3	0	
White.....	3	0	
Red	4 (8)	0	"What color?" and volunteer.
Yellow	11	0	
Blue	21 (7)	1	
Green.....	26	1	
Black.....	6	0	
White.....	2	2	

And the total result of three in the eighty-fourth and eighty-fifth weeks was:—

—	Right.	Wrong.	—	Right.	Wrong.
Red.....	19	4	Green	43	1
Yellow	19	0	Black	14	0
Blue.....	45	1	White	10	3

In the eighty-fourth week red suddenly recovered from the confusion with blue, but for the one week only. It is evident from the results of that week, as well as from all the former results with colors other than red and blue, that apart from the special difficulty in naming those two colors, it made no particular difference in which form the question was put; her habit of voluntarily attaching names to colors about her made it as easy as to find colors to fit the names. After the eighty-fourth week, therefore, I ceased to keep separate record; the usual form, however, was, "What color?" and in very many cases the colors were spontaneously named.

The one case in which I ever heard blue called green occurred in the eighty-fourth week, and was evidently mere heedlessness. White in the same week was twice called yellow. In the eighty-fifth week, 590th day, she called pink roses white; I thought this might be due to ignorance of the word pink, but later occurred instances of real confusion of white and pink.

She had fits of pointing to and naming all the colors about her. On the 590th day, *e. g.*, she asked (correctly) for a "red book," and carried it about, commenting, "Red book! red book!"—then pointed to the walnut banisters, observing, "Brown!" then to a "red pail," then ran into an adjoining room and showed me "blue birdies" on a Japanese wall decoration.

In the eighty-sixth week, orange was added. She had not heard this color name used incidentally, as she had black, brown, etc., but it delighted her very much, and never had to be named but once. It was given to her at the same time (598th day) that she received a present of a large number of new tablets, in various geometrical forms; and the first time that she had them in her hands, she sat for one hour in her mother's lap by a table, happily occupied in gathering out over and over all the orange and yellow tablets (some twenty in all), although she was tired, and kept awake far beyond her bedtime. Two days later they were put into her hands again, and she occupied herself again in the same way. If told to pick out the yellow ones she did not care to do so, but if left unnoticed gathered up every orange and yellow one, over and over, with absorbed interest. Yet an hour later, given them to occupy her at a meeting, she did not care much for them. Until her interest was freshly stimulated by the addition of orange, she had not cared as much for the tests as in the nineteenth month.

The results of nine tests in the eighty-sixth and eighty-seventh weeks follow. One of these was made before a roomful of people, after bedtime and by electric light; yet only the usual error as to red and blue occurred. Three other tests were made in the eighty-sixth week, of which I did not keep record, beyond the note that the only error was this usual one, which she always corrected as soon as her attention was called to it. With the beginning of the eighty-seventh week red was withdrawn to give her an opportunity to recover from what was becoming a fixed habit of confusion; so that in five of the nine tests it does not have any part.

—	Right.	Wrong.	—	Right.	Wrong.
Red	3	16	Black	46	0
Yellow	96	1	White	44	3
Blue	99	1	Orange	81	0
Green	104	2			

White was once called yellow again. The 610th day she called a piece of dingy white paper yellow. A roll of terra cotta wall paper was called, very doubtfully, orange. It was in fact a mixed and imperfect orange shade; but few grown people would have classified it as correctly.

In the course of a trip made on the 597th and 598th days, she was alert to see colors. As I stood by with her in my arms while her mother was shopping, she began pointing out the stockings on a counter, and naming over the colors, — "Green stockings! Red stockings!" blue, white, pink, black, brown, — with scarcely a slip. I did not know before that she could name pink, but concluded that she had picked it up from hearing her pink dress and bonnet spoken of. Having reason to think she knew a striped dress, I said, "Find some striped stockings." She looked all about, repeating, "Find striped stockings! No striped stockings!" though she was looking at some; after some seconds it came to her, and she pointed to them, crying joyously, "Striped stockings!" and then pointed out several other pair. She then looked about the store, and pointed out near and far "blue shirt!" "red box!" "green box!" shouting her discoveries aloud, till all the departments looked and smiled, and I carried her close to the boxes to moderate her

tones; she then named over quietly to me the colors of all the boxes in a row, and then asked for "more box." Soon after, taken into a strange parlor, her first act was to run to a small statue that stood on the floor, crying, "White man!" and embrace it. She had never seen a statue before. Some hours later, after a railroad trip, she was taken to a strange bedroom, and though fretful and absorbed in desire to go outdoors, the instant she entered the room, she ran across it to look at and name the silk balls hanging from the toilet stand, — "blue," "yellow;" then was puzzled by a brownish violet, and asked what it was. In the library she went as usual to the book shelves, naming the colors of the books, though she would not do this when strangers came in. Next day going home she asked about the color of the finishings in the railway car.

Nearly two weeks later I was talking to her of this trip, and mentioned our taking the street cars; she broke in with, "*Green* car!" Her attention had in fact at the time been drawn to the colors of the cars. A more striking instance of color memory occurred on the 600th day; seeing for the first time a yellow primrose in bloom by the edge of the daffodil bed, she called it at first glance a daffodil; yet she had seen no daffodil there or elsewhere for nearly twelve weeks.

The 601st day I tried whether she could hold the color idea in combination with another demand, as the variety of form just introduced into her tablets seemed to have caused not the slightest confusion; she proved able to select a "square green," "oblong yellow," "round black," tablet, and the like, with visible effort, and with some helping till she understood what was wanted, but in the main correctly.

Having been shown the difference in color of ripe and unripe loquats, she proved able to use it quite carefully as a means of discrimination, selecting the yellow and rejecting the green.

All the tests in the twentieth month give:—

—	Right.	Wrong.	—	Right.	Wrong.
Red.	25	24	Black	60	0
Yellow	121	1	White.....	54	6
Blue	155	7	Orange.....	81	0
Green	154	4			

Violet was introduced in the middle of the eighty-eighth week. The child seemed to care little for it, and several times refused to name it, and wished the colors put away when we came to it. She was apt to call it blue, but distinguished instantly when she saw them side by side. Seen in the shadow it was once or twice called black. Shadow did not confuse her as to yellow, blue, and green, which once fell behind the lounge, and were promptly named by her as she looked down; yet once in the ninetieth week a yellow tablet behind the lounge was called orange at first glance.

Five tests in the eighty-eighth and eighty-ninth weeks gave:—

—	Right.	Wrong.	—	Right.	Wrong.
Yellow	46	0	White.....	36	1
Blue.....	63	1	Orange.....	50	0
Green.....	55	0	Violet.....	31	9
Black	29	1			

I made one effort to reintroduce red, but the old mistake was made, and I put it away again.

The 624th day, playing with some little girls (an unusual thing) and in a new place, she answered questions as to the colors of flowers wildly, calling orange ones violet, pink ones orange, yet she answered other questions as difficult correctly.

In the ninetieth week, pink was added. Although she had used this name of her own notion in naming objects, she could not name the tablet till told, and afterward asked for the word once or twice; she never misnamed it, however, and could always select it. She was interested in it, and sought the pink ones, once gathering them all out, but did not care as much for it as for orange on its first introduction.

Red was then restored, and on the first trial but one mistake was made; on the second, she twice began to call it blue, then instantly caught herself up and corrected it. Once also she called blue red, hastily corrected to blue, then pointed to red, saying emphatically, "*That* red." Once or twice she picked up a red one of her own accord, saying, "*That red.*" My gown she instantly recognized as red.

In the ninety-first week, brown (burnt umber) was added. With

this, as with the pink, in spite of having seemed to know the word, she had to be told what the tablet was; and two days after had forgotten the name, though she would not miscall it, and answered readily when I resorted to the question, "Where is the brown?" She did not care much for it, and on one occasion when we came to it lost her interest in the lesson, refused to try to name it, and began turning over and naming those already earned and in her lap: "That one pink; that one blue;" etc.

In the following results from seven tests, in the ninetieth and ninety-first weeks, red enters into five, brown into three.

—	Right.	Wrong.	—	Right.	Wrong.	—	Right.	Wrong.
Red	25 (2)	3	Black.....	13	0	Violet	27	1
Yellow	30	0	White.....	18	3	Pink	28	0
Blue	30 (1)	0	Orange.....	28	1	Brown	5	1
Green	41	3						

In one of these tests, 633d day, after once or twice naming white correctly, she began persistently calling it pink, and did not seem able to correct herself; this did not seem a whim, but a real confusion. Even when the question was changed to, "Where is the white?" she at first pointed to the pink, then to the white, then became much disinclined to go on.

The one mistake made in orange, — the only one ever made, — was when, after she had gathered up all the pink tablets, she looked for more, picked up an orange one, and said that it was pink. This would have been quite natural had the pink used been salmon, which is an orange tint; but it was nearer rose.

The 630th day she was playing with some samples of paper of various "off" colors, and her mother, for curiosity, asked her to name them. She not only named difficult greens and blues, but called lilac "violet," — this several times consistently. There were two tints, one very light, almost lavender, which her mother said she had before called pink; a week later she called a gown of the red violet shade called heliotrope, "violet." A vermilion she called orange; salmon also she called orange. A tone between green and yellow she called yellow; we regarded it as green (perhaps wrongly)

and told her, "No." She then, without suggestion, found the yellow tablet and compared them, then said the paper was green.

This same day, on a street corner, I told her we must wait for a *blue* car. She recognized the right car as soon as it appeared, pointing and shouting, "Blue car!"

In the twenty-first month (including one test in the ninety-second week), the results were: —

—	Right.	Wrong.	—	Right.	Wrong.	—	Right.	Wrong.
Red.....	28	4	Black.....	46	1	Violet.....	60	10
Yellow.....	82	0	White.....	61	5	Pink.....	30	0
Blue.....	101	1	Orange.....	86	1	Brown.....	7	1
Green.....	103	3						

In the twenty-second month she was away from home for a couple of weeks, and for eighteen days had no trial with the colors. I visited her when she had been away three days, and her first remark after greeting was, "Red and green?" but when told the colors were left at home, thought no more about them. On her return, after having been at home some hours, interested in other recognitions, she suddenly ran to the closet, crying out for "oblongs" (657th day). The forms interested her for about three-quarters of an hour; but finally she put her finger on an orange tablet, and said more than once, "That one red." "Why, no, it is orange," I said. She looked at it doubtfully, and finally said, "Orange color." This was by lamplight, however; and when I tried next morning she proved to know the whole ten, perhaps not as instantly as before the interval.

She was not so easy to hold to the lesson now, having had the tablets to play with freely so much, and perhaps also having more will of her own as she grew older; on this day she was vexed at my holding them away from her till she had named them, and said repeatedly, "Hold down! let Ruth have!" Her interest, too, had gone away to the forms. It was indeed unnecessary to press color tests any farther, and I dropped them. She would sometimes, however, as she handled the tablets, mention their colors. I took one memorandum of such an occasion, and one formal test

after her return; no error whatever was made, and no hesitation or disposition to error shown. Pink was five times named, brown four, black and white each twice, the other colors each three times. She now first showed interest in brown, naming it as she played oftener than the others, and once searching for it, — "Where brown? — There!"

The colors were called, *wě* (red), *lě* (yellow), *boa*, *gee*, *ō cō* (orange color), *bibý* (violet), *pā* or *pū* (pink), *bow* (brown), *bā* (black), *fū* (white).

Though I consider the regular tests as ending, and her familiarity with the colors complete, at twenty-one months, in making a table of the total results of the tests, I add in the fragmentary results from the twenty-second month, as the number of tests for the last color introduced, brown, is so small. But for this one small addition, the period covered is exactly the third quarter of the year.

	JUDGMENTS, ¹		PER CENT.	
	Right.	Wrong.	Right.	Wrong.
1. Pink.....	35	0	100	0
2. Orange.....	170	1	99.4	.6
3. Black.....	108	1	99.1	.9
4. Green.....	311	8	97.5	2.5
5. Yellow.....	240	7	97.2	2.8
6. Blue.....	309	22	93.4	6.6
7. Brown.....	11	1	91.7	8.3
8. White.....	117	11	91.4	8.6
9. Violet.....	63	10	86.3	13.7
10. Red.....	76	52	59.4	40.6
Total.....	1,440	113	92.7	7.3

This table is somewhat misleading as showing the comparative standing of colors. The single error in brown counts out of its due proportion in so small a number. Orange and pink were added to the list at a late period, when her power of remembering names, and probably of distinguishing colors, was much advanced. Had she

¹ One test in the ninetieth week, in which over forty answers were given, without error, has been omitted, because my note fails to show the exact number of answers for each color. The most important difference its inclusion would make would be as to violet, whose percentage of right answers would become 87.6.

not fallen, when but eighteen months old, into the name confusion about red and blue, these colors would have been recorded with scarcely an error. Apart from the difficulty between red and blue, the only consistent errors were mistaking violet for blue, and white for yellow or pink. Violet and white, therefore, properly occupy the lowest place, as regards distinctness of seeing.

Our impression throughout was that she *liked* yellow best, though the only distinct evidence was that in her joy in the new and pleasing orange tablets, she included with them the familiar yellow; and such indications as were given by her manner in hailing the tablets with joy or indifference as they emerged from the box, were somewhat in favor of yellow.

I have tabulated my experiments with reference to comparison with Preyer's. The first impression on comparing is of a surprising superiority in color perception on the part of my niece. Some corrections to this idea must be mentioned. (1) Professor Preyer marked all answers as wrong that were first given wrong, even if the child corrected them himself, while I mark such answer right if it was corrected without suggestion. If I had conformed to Preyer's method on this point, my niece's percentage of correct answers would fall to 91. (2) My withdrawal of red lest the confusion concerning it should become infixed, removed for some weeks the chief source of error; while Preyer at one time withdrew for two weeks the two *best* known colors. I have estimated (on the basis of the percentages of correct answers as to the colors in question, and the proportionate *number* of answers usually given for them) that had there been no colors withdrawn, my niece's percentage of correct answers would have fallen to 90 per cent, or, combining with (1), to 88.7; while that of Preyer's child would have risen to 71.2. But the advantage given to my niece by being allowed time to recover from confusion and to fix the name of blue firmly before having that of red again before her attention, cannot be estimated in figures. (3) After the eighty-fifth week, I used only colors of medium brightness, and even before that no very pale tints or dark shades. The child's incidental experiences with tints and mixed tones show that she could distinguish them, but still they might materially have increased the proportion of error. Again, my list included white instead of gray, which may have saved some errors. Soon after the

suspension of the tests, however, having heard us speak of a paper sample she was playing with as gray, she took up the name, and thereafter named the color easily and without any error that we ever observed. (4) Probably most important of all, new colors were more *rapidly* added in Preyer's tests, thus increasing the difficulty of keeping the names clear.

My niece was undoubtedly much in advance in point of time, having before she was two years old as complete a knowledge of color as Preyer's child at three; and in the rapidity and spontaneity with which she acquired that knowledge. I credit the earlier development simply to her earlier acquisition of speech in general; and while evidence is wanting, I am disposed to think that almost any child in the second year would show an equal comprehension of color if his language was sufficiently advanced to test it. Indeed, where the power of speech permits, it is not unlikely that tests would be better followed in the second year than the third, because the child's independence is less, — he is more amenable to suggestion, and has fewer interests of his own to divert him from one supplied by the parent.¹ My niece may have received stimulus toward

¹ On this point compare the notes kindly supplied me from the record of Mrs. Lulu M. Chapman (A. B., University of California):—

"Before the child was two years old, no attempt had been made to teach him color, and he showed no liking for it, as in colored pictures.

"At two years and seven days he was shown the colored tablets,— wanted to take all, and showed no preference. Two other experiments in the next ten days gave the same result.

"One hundred and eighth week, being unable to interest the child in the color, I gave up the tablets, and began to speak of the color of common objects, 'Let's put on your blue dress,' etc. He began to use the names of colors immediately, but as a mere wanton use of words, delighting in using new ones, without any reference to the real colors of objects: *e. g.*, he often remarked, 'See *grin* horse,' and the like.

"One hundred and nineteenth week, I gave him the Hailmann beads, and as he played with them tried to get him to help me match them. He showed little interest; confounded red and orange, purple and blue, constantly.

"One hundred and twenty-second week, asked him for a red bead,— he gave me a yellow one. I said, 'No, that is yellow.' He then picked up all the yellow ones, saying with each, 'Yellow,' 'Yellow;' then collected the red ones easily; then lost interest. Two days later he picked up and named the yellow ones, then grew obtuse and refused to do anything. Next day when I pro-

interest in color from having always lived in bright sunshine, amid profuse color, with flowers as her constant playthings. I do not think that our early efforts to see if she could grasp color names had much to do in stimulating their use, for after all it arrived at about the same time as the use of other adjectives. The usual superiority of women over men in color discrimination is so easily accounted for by their attention to dress and household furnishing that it would be mere speculation, until further evidence, to conjecture that sex had any bearing on the question.

I now showed her, 659th day, the difference between light and dark green. She at once grasped it, and named them correctly half a dozen times. A week later I showed her the light green, and asked, "What kind of green is that?"—"Light green." "And that?"—She hesitated: "Black green—no!" I gave her the word *dark*, then altered positions and asked for it, and she selected it promptly. I then put the dark and light *blue* side by side, and asked her which was which: she could distinguish at once, following the analogy of the greens. Two days later, I asked her again and found that she stumbled over the light blue and dark blue when shown them separately, but shown them together distinguished at once; then of her own accord she selected "li gee" and "dä gee" several times. Nothing could have been more quick and clear than her comprehension of the nature of the distinction. From time to time since I have asked her the question as to red, yellow, gray, etc., and she never failed to distinguish if the two were seen together.

duced the box of beads he forestalled all experiments on my part by saying, 'You are my baby,—*you* say what color that.'

"In these experiments I did not ask the child directly the color of the beads, but suggested making a *yellow* train of cars, a *red* fence, etc. If he picked up the first bead at random, as he usually did, I rejected it, saying emphatically, 'No, we want *yellow* ones.'

"At no time did he appear to take any real interest in the color, just a forced one for the sake of something else."

Mrs. Katherine Slack (Ph. B., University of California) had a similar experience with her daughter, about two years old. It was impossible to occupy her mind with the simple color demand; she wished to have the tablets, to play they were money, to do this and that. Both these children were more ingenious and imaginative than my niece, and more advanced in speech. I judge they were quite as able to distinguish color, but not interested in so simple an occupation. They are both city bred.

The next day she showed a curious lapse in what seemed perfectly fixed knowledge, by calling a blue bird on some Japanese panels red, and a brown bird blue. It was the last instance of such confusions: the next day while in the midst of a wail over a bump, she chanced to glance at the book shelves, and cried: "Blue book up there! Violet book up there! Blue book and violet book!" pointing. The "violet book" was a very violet blue, and standing next a pale, unmixed blue, looked still nearer violet. She was fascinated with the shelves for some time, pointing to book after book, and naming its color, — red, green, and blue, all correctly; green especially was recognized in various indeterminate tones. A brown that approached an orange-red shade, she first called orange, then, dissatisfied, asked, "What that?" I told her a sort of brown. "No. *That* brown," she said, pointing to one nearer the burnt umber; "that brown; that brown," indicating one after another discriminatingly. A dark greenish blue, exceedingly difficult to determine, called out the comment, "That blue." Having gone about my affairs, I found her a little later trying with zeal to collect all the red books she could climb up to, — "There another red one; Ruth want red book." Later in the day she found some tablets I had laid aside, which were meant as transitions between the colors, and pulled them from the envelope, saying of the orange-red, "That orange," but of the red-violet, blue-green, orange-yellow, "What that?" Her mother said that during the early part of the month she insisted on calling a bright brown dog orange.

Though she desired the tablets chiefly for their forms, the next day she occupied herself in gathering out the white ones, without reference to figure; the day after, the white circles only were culled out.

In the twenty-third month, 685th day, I again noted some comments as she pulled out the books. Once, "That white — these white," glancing from the book she held in her hand to the row of white ones. Red-brown books she called red, other browns brown. She declined to recognize a light blue as blue, though she gave it no other name. When I called a violet-blue "blue," she corrected me, "That violet." It was really almost as near to violet as to blue.

Color names were in this last quarter year used as freely as any words in her talk. Thus, 666th day, gathering seeds from an

acacia branch where both ripe and unripe ones hung, she kept up a broken comment: — "Have black seeds. Ruth got green seeds, — black seeds. — No; green: aunty hold down [*i. e.*, I wish to have black seeds. I have green, — I am going to get black. — No, I have green again: I wish aunty to hold down the branch.] — Black seeds way up there. — There black seeds. — These green seeds. — Ruth have black seeds; aunty have these [green ones]." So in the twenty-third month, *e. g.*, she begged for "aunty's white hat;" and as we drove away from a standing train at twilight, losing sight of the lantern at the rear, "I don't know where green light"; as she failed to string a bead, "That time Ruth did n't get red ball;" seeing her dress on the line, "Aunty, that Ruth dear little pink dress;" of a lamp chimney, "That get pretty black." In the twenty-fourth month, *e. g.*, looking out of the window to see things in the garden, "Where red geraniums?" selecting among colored lozenges, "Ruth did take violet;" seeing a bunch of balloons, "Mamma, see that balloon! Ruth want that beautiful violet balloon, and that beautiful green balloon too!" (The last two instances from her mother's notes, during an absence.)

The most marked form of color interest during the twenty-third and twenty-fourth months was with regard to our gowns. She had anticipated this once at the end of the twenty-first month: seeing me about to change my gown, she urged, "Aunty, put on blue dress!" I brought out the heliotrope gown I was about to put on, but she persisted in urging the blue, and I indulged her. She now recurred to the interest as a habit: the 674th day she cried out the moment I entered the breakfast room that I had another dress on, not my blue dress; and next day came to my room just as I was dressed, and seeing the brown gown laid aside, commented, "Aunty need blue dress; aunty does n't need that dress any more." She was also interested to have me wear a figured challi with lemon ground, which she called yellow. She often came to my room in the morning before I was dressed. and at such times I usually had to reason with her if I wished to put on a dull-colored gown. The 719th day, seeing a brown gown laid out, "Aunty don't need this dress," and running to the closet she managed to jerk from the hook a blue one, and urged me to wear it. The 729th day she had been away all day, and in the afternoon I had changed a brown gown

for the lemon one; on her return at twilight I went out to lift her from the carriage, and was greeted, "Aunty, you did n't want your brown dress on; you want your yellow dress." After she had had her dinner, she returned to the subject, and asked why I did not wear my "black dress," a gown that had excited her curiosity several times, being seldom seen. Next morning, after remarking as usual on my gown, she asked if I did not wish to put on my "black silk." I never thought her preferences among my gowns altogether due to color; she doubtless had choices as to cut and trimming, and association counted for something,—the dull gowns were oftener worn when I went to the city, the brighter ones when I stayed with her.

Finally, as to the light thrown upon color interest and color preference, aside from what has already been given in connection with the color names:—

In the nineteenth month, the flowers that interested her (besides roses, which were always favorites) were nasturtiums and fuchsias, — red, yellow, and purple. In the latter part of the twentieth month, she was perfectly fascinated with red gladioles just coming into bloom, and hung about the buds trying to peep in where the color showed. The yellow and yellow-mottled leaves on a euonymus attracted her like flowers, and she was very desirous of picking them. She was especially fond of sweet peas, pink and purple, but their long stems had much to do with it. She seemed at this time to prefer the blue and green books on my shelves, but size and convenience of carrying about was her chief standard of selection. In the twenty-third month she was often occupied in stringing Hailmann beads; the first time she seemed to prefer red and orange, showing no great liking for yellow; the second, she chose first the red, then orange, then yellow, and though she gave preference to balls to string, would take the cubes of warm colors before the balls of cold, — when all the warm colors were gone she took green, blue, and violet at random. This was in the evening; the next time, by bright morning light, she took first yellow, then red, and one blue bead in the midst of the red and yellow. I thought the red beads better liked than the red tablets because they were of a yellower tone. A few days later, in still brighter light, outdoors, she seemed better pleased with the violet, green, and blue beads than in the house, but still pre-

ferred the warm colors. On another occasion she gave some preference to green; on another to orange, then red. In the twenty-fourth month, red, yellow, and orange was once the order of preference, then violet or blue; another time yellow was slightly preferred; another time, at the very end of the month, violet was first selected, then yellow, green, and blue, while red and orange were rejected altogether. In all other cases the colors were taken at random.

It is scarcely possible to generalize from these contradictory choices, but it is sufficiently evident that the warm colors were still, throughout the second year, better liked than the cold, though the difference was not so marked as in the first year. Yet although I watched with the expectation of finding evidence that the cold colors were not clearly *seen* by her, I never saw any reason to think that in the last half of the second year there was any material difference between her color seeing and ours. Indeed, her discrimination of mixed colors was sometimes better than mine, as I would learn by later comparison with standards.¹ That the cold colors were duller to her than to us seems likely; but the difference from adult vision certainly could not have been great. I never heard her miscall any of them as gray, in whatever tint; though she did sometimes call their dark shades black, especially in dim light.

¹ Bradley's Educational Colored Papers.

7. Form.

This subject belongs in the main under Sight; and though the perception of solid form brings in both Feeling and Inference, I do not wish to divide the topic, and so place it here.

Passing over for the moment¹ those primitive observations by which a baby familiarizes itself with form, first in looking from all sides at objects, then in handling them, the first definite observations I made were with reference to the confusion of plane and solid form. This was not frequent. In the twentieth week, as soon as seizing had fairly become a habit, the baby would put out her hands for pictures on the wall, figures on the tray, roses on the quilt; but seemed easily to learn what could be taken hold of, and I have no farther note of such errors (unless her putting out her hands to *touch* pictures on the wall, to which she was held up) till the 154th day, when she spent some time dabbing at the pictures in a colored linen book and trying to pick them up, but never afterward that I saw; and again on the 167th day she tried to pick up figures on the carpet, and the 177th to take in her hand a hole in a knit shawl, which looked dark in the colored wool. I have no note of a similar error later than the sixth month, except that at the end of the ninth, 271st day, she tried with some persistence to pick up the moving shadow of a rope end on the deck of a yacht; the motion probably deceiving her in this case.

Two odd indications of entire dependence on former experience instead of direct comprehension of form, occurred just before and just after she was six months old. She was very fond of drawing our hair through her fingers; and the 181st day, getting a chance to try her uncle's, which was visibly unpullable, scolded with comical disappointment at finding the close-shorn ends could not be seized. This happened again on the 185th day. On the same day she was given a round cracker for the first time. She turned it about carefully, as she was accustomed to do with a square one, seeking the corner to bite.

All her recognition of objects, of course, rested largely on dis-

¹See *Interpretation* below.

crimination of form; and still more her recognition of uncolored pictures, which began in the eleventh month. She never, from this time on, showed any distinct preference for colored over uncolored pictures. I have so many notes on recognition of pictures, however, that I shall make a separate group of them.

About the beginning of the twelfth month her grandmother taught her the letter O, which she first pointed out correctly the 343d day and always knew thereafter; a little later the same day she found a large Q, on the letter card she was playing with, and held it out to her grandmother with a questioning sound. She evidently recognized the resemblance to the figure she knew, and yet regarded it with doubt, conscious of a difference.

By the middle of the thirteenth month she knew O in all sizes large enough to be clear of the context, rarely smaller than bourgeois upper case (O), but the 382d day she picked it out in the midst of bourgeois text (o). In the next few days she was disposed to hunt for and announce lower case o's in books, but sometimes mistook c for o.

Near the end of the month, 393d day, her grandmother taught her S, which she learned without trouble. Her curiosity and questions about Q led her mother finally to give her its name, and before the end of the sixteenth month she knew it well. In the eighteenth month she pointed out and named O and S frequently.

The 543d day her mother marked a square and circle on paper, and named them once to the child, who thereafter distinguished them with ease; this I did not see, but later in the day, being told of it, tried it myself, and found that she named the two figures readily without mistake. Her mother had named the circle to her as "round O," and this was not entirely replaced by "circle" before the third year.

The 553d day, in the nineteenth month, she called a roughly made square "ká," without the least hesitation. She often asked to have "wou' O" made for her on paper; and on the 559th day began without suggestion to try to make it herself, carrying the line around to meet itself in a long, uneven loop, saying, "Wou,' wou' O!" as she did it. She liked to see a square drawn, laughing when I began it, and calling, "Ká!" and "More!" till I had drawn a great many. The 563d day she started to draw a "wou' O," then began

calling it a "wou' kâ," round square. I thought from the motion of her hand she was really aiming at a square; however, it did not approximate one, and she made no further attempt at squares. She continued to ask to have the figures she knew drawn for her at intervals throughout the year, and to try circles and later ellipses herself.

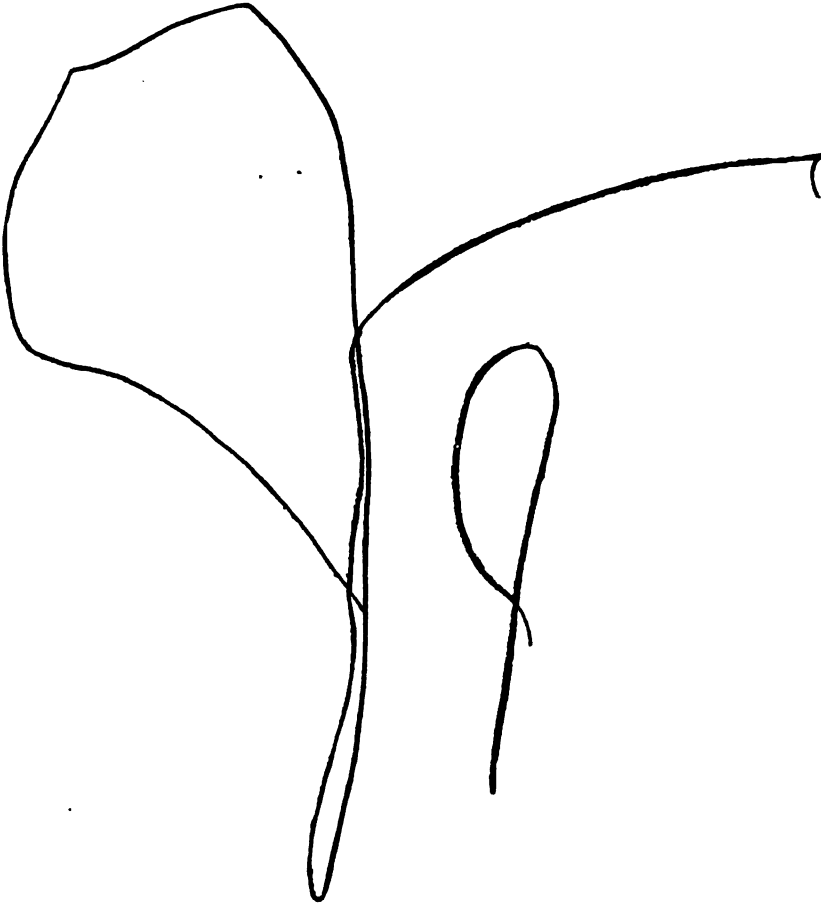


Fig. 1. First attempts at circle, 559th day.¹

¹ In tracing these attempts for reproduction (with the exception of Fig. 2), pains has been taken to preserve the *character* of the line, but it has necessarily lost a trifle in decision. Figs. 2 and 4 are $\frac{1}{4}$ the original diameter.

Fig. 2. Early attempt at circle, 566th day.

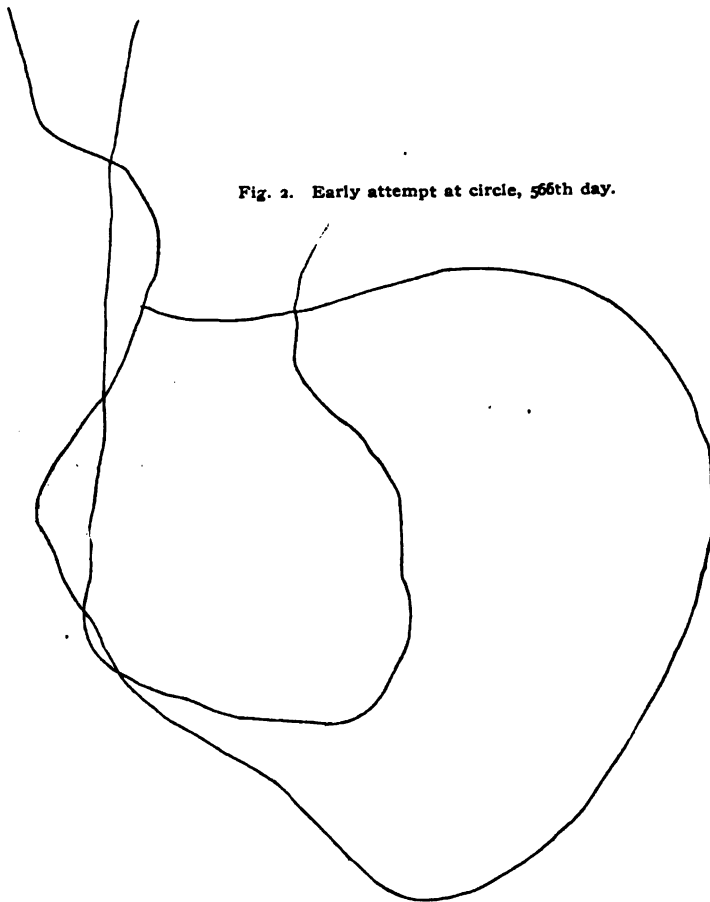
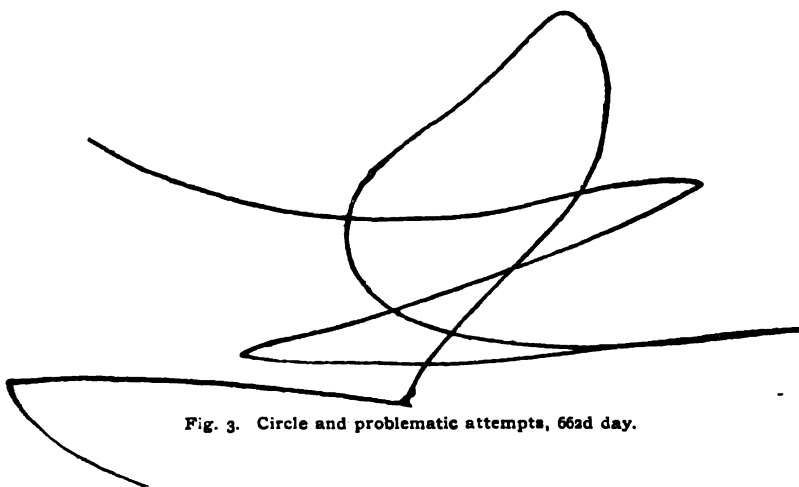


Fig. 3. Circle and problematic attempts, 662d day.



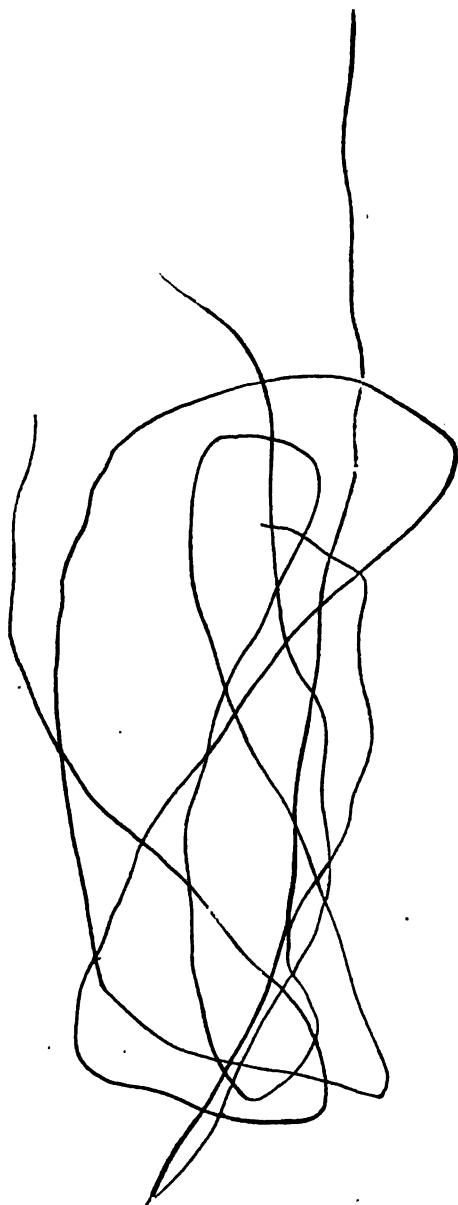


Fig 4. First attempt at ellipses, 673d day. Very typical of drawings in 23d month.

Here was an interest in form, and an ability to discriminate it, that should perhaps have given it precedence over color in my experiments; certainly to distinguish and name a lower case bourgeois o in the middle of text in the thirteenth month, was proof of ability to distinguish and name a circle, and probably other figures, some time before she could name colors. My attention, however, was on the color tests, and I deprecated following up the subject of form for fear of making too much demand on her attention. Beyond the occasional drawing of the figures for her, and probably a few random inquiries as to their names, nothing more was said to her about it till late in the twentieth month, 598th day, when the new tablets mentioned under Color,—squares, circles, and oblongs,—were given her; those I had used before were all oblong. After turning them over a little, she noticed that some were circles, and spoke of it. I then asked, "What is this?" showing a square. She did not at first understand what I wished; then suddenly cried that it was a "bi' boo kâ!" a big blue square. The combination of the color and form observation spontaneously made on this occasion, she found harder to make on request a few days later, as related above under Color.

For a few days after the gift of these tablets her interest in them was to gather out the yellow and orange ones; but within a week she began to select by forms, and would pick up all the circles, or the oblongs, never the squares, and pile them in her hand with the remark, "Ruth pile;" a method of occupation with them that lasted with little decline of interest till the twenty-fourth month. Oblongs were from the first somewhat favored in these selections, and in the latter part of the twenty-first month, this preference and the indifference to squares became quite marked. The 628th day I had been giving her a color test, in which she had answered cheerfully and correctly till I came to the squares, then had refused to go on; I then laid the oblongs away in the box and gave her the other figures; but she began to call, "Oblong! Oblong in box!" and continued to appeal till I gave them to her. If I asked whether she would have squares or rounds, she would always say "rounds," and sort out the squares and hand to me, but carefully stow every circle in her own hand; once in the last week of the month, however, left without any request from me, she took the oblongs for herself, turning

over the squares as usual to me. It evidently required absorption of mind thus to carry two sets at once in her attention, and she would be annoyed when sorting squares and oblongs to be asked about circles or triangles. On the 632d day she began to call for the tablets under the name of "oblongs," instead of "colors;" this, unlike her "red and green" for the colors in general, corresponded to her preference. In the twenty-fourth month she called them "shapes."

The 657th day, having the evening before just renewed her acquaintance with the tablets after some two weeks' absence, she asked for the "oblongs" before breakfast, and when I took occasion to give her a color test, wished only the oblong ones used. After her bath and breakfast, she went immediately to look for her cap to go outdoors, and asked for the "oblongs" to take with her. Allowed to play with them on the doorstep, and offered a square, she protested, "Ruth want *oblong*." I gave her the box and she shook them all out, then picked up every oblong. As she took the last one from each little group in which the tablets lay scattered, she would say, "No more oblong there." At first I said, "Why, yes, aunty sees more oblongs," but she answered, "No more oblong *there*," and turned to another group. After getting all the oblongs, she picked up the squares one by one, put them in the box, and suggested that it be put away. The others she treated with indifference. Two days later, having asked for "oblongs" and received the box, she at once chose out all the oblongs, and then ignoring the rest, proposed she should "go outdoors with the oblongs." Upon suggestion, however, she chose out the circles and squares and handed me. "Aunty don't want oblong; aunty want square," she observed, probably interpreting thus my efforts to prevent the square's being entirely forgotten. When I ranged them in rows by shape, she was interested and tried to help, but did not get the idea of a row; when I began to arrange them by color, she objected whenever I put an oblong aside and rescued it each time, with, "No, *Ruth* want oblong."

Two days later I asked her, "Which does Ruth like best?" naming over the shapes. She did not understand the form of question, so I asked again, "Which does Ruth like?" and she answered, "Oblong." On the 669th day, as I took down the box at her

request for "oblongs" she remarked, "Ruth not want square," then, "Not triangle." And she did in fact occupy herself gathering out circles and oblongs, — the white ones only, though she had been indifferent to color. The next day, the last of the twenty-second month, she chose white circles only, and during the twenty-third month collected circles rather than oblongs; but she was by this time losing interest in the tablets altogether, and in the twenty-fourth month did not occupy herself much with them.

The interest in the oblong, which had for six weeks been so persistent, was probably simply due to convenience in holding; the oblong tablets fitted her little fist very nicely, and she was solicitous to have them laid in an even pile therein. On the 630th day she was displeased that they were uneven, and called on her mother to "fix" them. The 634th day she found two very long and narrow oblongs, which had been cut from colored card, and tried to fit them in with the others, but finding she could not, rejected them as "too big." Two others, which were smaller than her set, she did not object to as too little, but was delighted with them, crying out over them as "cunning little bit oblongs!" and losing them and finding again with joy. The circles were somewhat less convenient, and the squares, with their corners, least of all.

Though her spontaneous sortings out showed that from the first she distinguished the figures easily, she had up to the end of the twenty-first month some difficulty in naming them. In the first week that she had them, the eighty-sixth, though she had seemed to know two of the three forms well when drawn, if asked to give either one she chose it hesitantly, and not always rightly. The next week, told to gather out the "rounds" she did it, 608th day, hesitantly, but with growing confidence as we encouraged her, till she had them all. By the eighty-ninth week the oblong, though the favorite, was the only one she could not distinguish easily when called for; she confused it a little with the square. When asked to name them she made occasional mistakes in all. The next week she could find any one when called for, but could not always name the oblong and triangle.

This fourth figure, with which she was much pleased, I had introduced to her in the eighty-ninth week, 618th day. The 630th

day, hearing something said of triangles, she began to beg for "ti-ă," and her mother made her one out of paper; then, thinking it well that she should have some among her tablets, a cousin present bisected several of the squares; she was much interested in this, and understood that they were made from squares, for she went and found another square and brought it to her cousin, asking for "more triangle." She also kept her mother cutting more out of paper, and wished to preserve these carefully with her tablets; and the 634th day neglected her favorite oblongs for a time to gather out the new form instead.

After the ninetieth week I never heard her misname any of the plane forms. In the ninety-first, the last week of the month, I took occasion three times after a color test to ask a few questions as to the figures, and was always answered correctly. The number of answers noted was

Circle 2, Square 5, Oblong 17, Triangle 12.

After this she seemed as familiar with the names as with "table" or "chair." Upon her return on the 656th day from the two weeks' absence in the twenty-second month mentioned above, her first indoor interest was to run to the closet and ask for "oblong;" and while she pulled them over for nearly three-fourths of an hour, she commented: "That oblong;" "That triangle;" "That square;" "Ruth don't want round O," handing it to her mother; "Auntie have round O;" etc. The 659th day, as she collected out either set, she would observe, "There another oblong. . . . No more oblong? — *There* oblong," — or square, or whatever the one she was collecting. If she picked up a wrong one by accident, she would say as she rejected it, "That round," triangle, etc. The forms drawn were as invariably called correctly as in the tablets. At this time, and indeed by the end of the twenty-first month, she could tell the letters O, S, and B instantly wherever seen.

As the O seen in print is so often an ellipse, I had tried to disconnect its name from the circle, compromising with her name of "round O" by saying "round;" she had not taken this up to any extent, however. Just before the end of the twenty-second month, the 669th day, she pointed out a small artificial pond in form an ellipse, as a "round O." This decided me to give her the word circle, which she at first objected to, saying, "No!" but soon took up at least

in part; and also to teach her the ellipse. She took this figure up with pleasure, and an hour later could name it, "el-li," or find it if asked for. She did not remember the word next day, but knew the figure very well, and distinguished it from circle without the least difficulty. She took much interest in it, and kept me drawing "another ellipse" for a long time. The 675th day she tried to draw ellipses as well as circles. The 693d day I began to set her oblong tablets in a row, saying by a slip of tongue, "Aunty will put the ellipses in a row." She cried out in deep concern "Aunty, these not ellipse,—these oblong," and it was not till I had made the amplest retraction and apology that she ceased repeating, "These not ellipse, these oblong!"

The effort to name the form of the pond was an instance of a habit taken up something over a week before—the application of her knowledge of figures to objects about her. As she sat on her mother's lap to be wiped after her bath she suddenly cried, pointing to the wooden frame of the tub, "Cunning little oblong!" There was a roughly oblong scar or spot on the wood. I pointed out to her another, approximately triangular, and she called it a triangle. Later I showed her the points of a man's collar turned over, and asked their shape; she said, "Triangle." Her mother said that the day before she called bobbins "cunning little oblong spools." The next day, again while being wiped after her bath, she cried suddenly, pointing to some circular figures in the border of the towel, "Round O there!" then, looking about the room, "No more round O;" then as her eyes rested on the door panels, she shouted with much vivacity and joy, "That oblong over there!" pointing; then pointing to the lower panels, which are smaller, "That cunning little oblong." As we laughed at this estimate of size, she thought it must be funny, and kept repeating, and made no farther search for forms. The 668th day she drew a hairpin from her mother's hair (again while being wiped after her bath) and pulled the points apart some forty-five degrees; then, struck by its appearance, held it up and cried, "Triangle!" A half hour later I gave her a hairpin and suggested that she make a triangle, and she drew the points apart as before, held it up, and announced, "Ti-a!" The next day, 667th, she drew my attention to the triangles on the corner of a writing tablet, and

the 668th named those on the corners of a book thus finished ornamentally. In the twenty-third month she recognized the plane figures with pleasure when her mother laid building blocks to outline them (673d day) and later brought them to me to "make oblong." When I had made one she said, "That big oblong; make little oblong." After it was made, "Make no more oblong. Ruth take back," and carried back the blocks. In the evening I made a triangle with my fingers and held them up to her without naming the figure. Perhaps because she was at dinner this seemed to annoy her, and she said, "Make no more triangle." The 691st day she tried to put a circle of cloth over her doll's feet, observing, "Ruth try put on round O — for Tommy feet — little drawers." The 695th day, she set her shoes with heels together and toes diverging, and said, "Ruth shoes make triangle;" then set them parallel,— "Now make oblong."

The flexibility and perfection of her knowledge of these figures was surprising to everyone who saw her show it. From this time on, at intervals, she has always noticed and named the plane figures to be seen about her, in buildings, furniture, etc. Yet on the 699th day when I called her attention to the fact that the moon was round, she objected. "That not round O — that moon." — "Yes, it is not a round O; it is the round moon." She made no further remonstrance and looked at the moon thoughtfully.

Of course the forms she observed about her were often quite inexact; I had observed from the middle of the twenty-first month that it seemed even easier for her to see the essential plane form in a rough approximation than the essential color in mixed tones. The day after I showed her the triangle, the 619th, I found her playing with rough paper shapes, which her mother had been tearing out of paper; her mother said that the child had herself torn off oblongs from a strip of paper and named them rightly. As I looked on, she picked up two or three roughly triangular fragments and called them triangles. The oblongs cut for her from cardboard were of various proportions, but she called them all oblongs readily. That she *could* discriminate by comparatively small differences in form, however, was evident from her easily distinguishing the circle and ellipse.

Just before the end of the twenty-second month, 666th day, I asked her as she played with some building blocks, long quadrangular prisms, "What shape is that?" The question was unreasonable, for she had no reason to suppose "shape" referred to anything but plane surface; but she responded instantly, "Oblong." Shorter ones were "cunning little oblongs;" a cube she called a square.¹ Showed the end of the form she called an oblong she hesitated, visibly puzzled by the contradiction, but said it was square. A cube cut diagonally she had no name for, and was not interested in.

Early in the twenty-third month, 673d day, I gave her the Hailmann beads, — small spheres, cubes, and cylinders for stringing. I gave her the spheres only, which I called balls, thinking the word simpler and quite as exact. She was greatly interested in them, but not at all disposed to string them, and wished merely to tumble them about. The next day I kept them in my own hands, and, using both cubes and spheres, insisted on her earning them to play with by first stringing them. With more trouble than I had had with any similar exercise, I established this habit. The cubes were easier to string, but she liked the balls best. She began at once to use "little balls" as a general name for the beads, and to coax for them. *E. g.*, the evening after I had taught her to string them, she asked for them again and was put off till after dinner; and although the dinner chanced to involve a long and exciting contest on a point of table behavior, and also a great deal of concern over a plum that had been promised her some time before, when it was all over and hands washed, she ran to me, laid both hands on my arm and jumped up and down by it, reached up and kissed me on both cheeks, then cried, "Now little balls!" The next morning she asked for them soon after breakfast. Within three weeks her interest flagged, but was renewed by my bringing out the cylinders on the 692d day, and lasted till the middle of the twenty-fourth month.

It was hard to get her to accept the name "cube;" she called the cubes "squares." By the 676th day, the third of her acquaintance with them, she would point them out correctly if asked, but still did not have the word; the 680th day she still called them squares;

¹I have repeatedly heard grown people call the prism an oblong, and the cube a square.

the 681st instead of asking for "little balls," she asked for the "squares — no —" and hesitated. I tried to get the word cube from her in vain, yet asked to point out the cube, she could do it unerringly. I brought out the square tablets and showed one to her beside a cube; she could tell which was which with ease, and was interested in the points of difference, and tried to carry on my exposition by turning over the cube and saying, "That got hole in." I had already provided against her regarding this an essential part of a cube by showing her the cubes among the building blocks, and when I reminded her that they had no holes, she assented. Four days later she was still troubled by the word, and asked for it would hesitate, — "Kâ? — no?" and finally "coo!" with an effort. With the name "cylinder" she experienced little trouble. During the twenty-fourth month she asked for the beads either as cubes, or "my little cubes and cylinders."

The 675th day after showing her, as mentioned above, that the cubes among the building blocks had no holes, I asked her to find me some cubes in the box. She presently cried out with joy that she had one and came to show me the half-cube. I turned it all over and showed her its shape, saying, "That is not a cube." "No — that triangle," she said, and went back with me and found a cube. When I showed her the two side by side, she said again, "That triangle." Though she accepted the building blocks, which were not much larger than the beads, as cubes, it was very hard for her to generalize the idea of solid form, and at the very time we were so struck with her ready discernment of the plane forms everywhere, she refused, 695th day, to accept as cubes her larger letter blocks. I succeeded, however, in having her accept an Indian bead, longer and slenderer than the Hailmann bead, as a cylinder; and the 699th day I told her to find a cube in her box of blocks, and she seized at once one of the large letter blocks and said, "There cube!" then searched in the box and found a prism that was of such length as to equal two cubes. "That not cube, that oblong," she said, then found the half cubes, saying of each, "That not cube,—that triangle;" finally a cube, "That cube." Finding an irregular piece from a door frame among the blocks, "What that?" She was interested on being shown that a rolled up picture was a cylinder. Once in the twenty-fourth month, asked the shape

of a straw, she said, "oblong," but agreed when told it was a cylinder. Although when told she could perceive some correspondence between the forms of other objects and those so well known in her beads, she did not at any time apply the lesson herself, and though for a while she was fond of the beads as playthings, she took no such interest in solid form as in plane form, and showed no such power of comprehending it.

The 678th day I showed her that the cubes stood firm, while balls rolled round at a slight movement of the box. Two days later, taking a ball to string, she laid it down, saying, "Ball won't stand." The 685th day again she commented, "Little balls roll, little cubes stand still." This point she never forgot, and it interested her moderately; but I did not see her show any farther interest in the properties and differences of the forms. Once, 694th day, I asked her what was the shape of the shadows of the cylinders, and she answered oblong easily, but showed no especial interest, and never reverted to the fact in any way. Her playing with the beads had no originality, and unless closely supervised by me, degenerated at once into mere scattering them about. In the ninety-ninth week she tried a little to place them, and also the tablets in rows, but she had often seen me do this. There were also some interesting experiments in piling and grouping, but they have more bearing on the subject of number than form. The solid forms, as forms, were evidently not very interesting or suggestive to her.

The last day of the year but one, I tried an experiment that I will for completeness place here, instead of under the head of Feeling. I put several beads of each form into a bag and let the child take out one at a time, telling me what it was before she brought it to sight. She named the cube three times right, and once said it was a ball; the ball three times right, and wrong not at all; the cylinder was once called a cube, once named rightly. The exercise amused her much, and she laughed aloud at each effort. This play was tried a few times in the third year with similar results.

I will add that now in the third year I still fail to wake any decided interest, or any originality of observation concerning solid form; color and plane form are no longer matters of curiosity, and her attention is not on them, but they are matters of everyday interest, and color especially is habitually noticed and often commented on.

8. Pictures and Other Representations.

Although from the fourth month the baby liked to look at pictures on the wall when held up to them, the first entirely spontaneous notice taken of them was not till the tenth month, when she suddenly (277th day) noticed with joy a colored picture of a child, and thereafter noticed it persistently, and also desired to be carried about to see the other pictures.¹ About the same time she began to notice and desire a card photograph of herself and grandfather on the mantel, and with a little suggestion kissed them, but I do not think she recognized them as representations. She was taught in the forty-first week to look at a picture on the wall when asked, "Where is Mr. Longfellow?" but had no idea of its meaning, and indeed for some time confused it with some colored figures in the frieze above. On the 286th day she became confused between her grandfather and the picture, which I attributed to mere confusion between the names, as she was but just beginning to understand words; but it may have been that the white beard and slight general likeness had something to do with it. The next day, asked for Longfellow, she turned and pointed to a companion picture of Emerson on another wall, showing that she had observed the resemblance. After this she repeatedly showed unmistakably that she compared the three other portraits on the wall with Longfellow, but not two Raphael cherubs, not far from the same size. Yet as late as the 309th day, in other houses, asked for Longfellow, she would point to any picture in a similar location on the wall, but not to a similar picture of Longfellow in a different place.

The 293d day I first thought she saw the relation of a picture to

¹Mrs. Beatty's boy was interested in the fourth month in uncolored pictures shown him, 113th day, and the next day seemed trying to get hold of flowers on the lounge cover. At eleven months he was much interested in pictures on the wall; the 336th day, taken into a room where a large engraving of Tennyson had been hung, he noticed it at once, pointed to it, and wished to go near; looked at it with delight, then at his mother, then around at the other pictures. Every time he was taken into the room, during this and the next day, he wished to be taken to it and to look at it. A copy of the Sistine Madonna was also a favorite.

an object. She was shown a life-size painting of a cat, and told it was "kitty." The cats were at that time objects of exciting interest, and she now became excited over this picture, crying out as she did at sight of the cats, and thereafter seemed to recognize it without difficulty, judging by the similarity of demonstration toward it and the real cats. Within the next month she made discovery of the purpose of a smaller picture of a cat, uncolored, in a picture book. The pictures in this book had been named over to her as the pages were turned, merely to amuse her, without effort to teach, and I had no idea she knew any; but on the 327th day I asked at random, "Where is the kitty?" when, to my surprise, she turned over the leaves and found a picture of a cat's head, full front, and put her finger on it with a cry. She could not do this again that day, but a day or two later, proved to be perfectly sure of it, though other pictures of cats in the book, which were colored, were not noticed; she would turn the leaves searching for it unasked.

Earlier than this, however, on the 316th day, noticing her interest in flowers on my gown, I said, "Where are the flowers?" She leaned over and touched them, then immediately looked out to the garden with a cry of desire. Next day, standing near the wall, far from a window, I asked, "Where are the flowers?" She leaned from my arms and put her finger on a rose on the wall paper. I carried her nearer the window and asked again, and she pointed out of the window with a cry of desire. At another time, asked the same question, she pointed first to the pictured flowers, then to flowers in a vase. She never at this time pointed to rosettes or conventional figures as flowers. In the second year, however, and so late as the eighteenth month, she did occasionally mistake such a figure for a picture of a flower. The 333d day, she could point, when asked, to a picture of a dog on the wall, and probably understood what it represented.

As she did not try to treat the pictured objects as real ones, yet attached the same name to them as to the real ones, and experienced desire for the object at sight of the representation, it would seem that at eleven months she understood the purport of a picture quite well. The only time up to this date that she had seemed to confuse one with the reality, was on the 329th and 330th days, when she offered her cracker to the portraits on the walls, but she also offered

it to other objects, and I thought it a sort of whim or play, partly suggested to her. In the second year, two other instances occurred; the 402d day she bent to smell a picture of a rose, and the 477th, after asking each member of the family to reproduce a sneeze that had interested her, she appealed to the portraits to do it. The 499th day, also, she was perplexed by a realistic picture card, in which a donkey put his head through a window that was actually cut out; she turned this over and seemed surprised to find only blank paper and a hole, into which she put her fingers curiously, saying, "Fo!" (hole). She never tried to feel or pick up a picture.

The twelfth month, birds on a screen and a cup, and cat, dog, and flowers in all pictures came to be recognized; once, 349th day, she pointed out a ball in an uncolored picture. In the thirteenth month, 378th day, she recognized a small picture of kittens, not more than an inch long; in the fifty-fifth week, without any teaching beyond her acquaintance with the objects represented, she could point out kitty's ribbon, kitty's eyes, the man's glasses, etc., in pictures, and would greet a pictured dog with "bow wow," as readily as a real one. In the fourteenth month, 399th day, she compared a cap on a cat in a picture with her grandmother's cap, and would sometimes point out eyes, hair, and feet in the small figures in her books. The 405th day she pointed to a small, uncolored photo-engraving of a horse, then through the window to a horse tied outside; she had for nearly a month been deeply interested in this and companion pictures of horses, and I thought from the first that she understood them. In the fifteenth month, 446th day, seeing a picture of the "three little kittens" seated at dinner, she began to smack her lips, pointing to the table. At sixteen months, though she had long known flowers in general in any picture, she recognized daffodils and violets, and at about twenty months, sweet peas, poppies, and poppy buds, only in colored pictures; yet by the end of the eighteenth month she could point out flower, leaf, and stem, untaught, in rough and uncolored representations. At nineteen months (578th day), after being shown the beak of a little dead bird, she knew the beaks of birds in pictures.

From the thirteenth month she could understand pictures of known animals in *all positions*, showing that she must already have

a clear remembrance of the living animal in all these. The 384th day, given a new picture book, she recognized all the cats and most of the dogs in it, in whatever positions; by the first week of the fourteenth month, flowers, trees, cats, dogs, cows, and probably other objects, were recognized in any good picture, in whatever color, size, or position,—a cow stamped on a butter pail once, 445th day. Very slight resemblances seemed enough, while large differences were unobserved; indeed, she once said “moo” at a picture of a camel (445th day). Yet differences once accepted by her as significant were recognized without error; thus donkeys and horses were easily known apart. This was the more noticeable, as a donkey, known *only* in a picture, was recognized at once in other pictures in quite different positions; this could only have been by the analogy of a horse, yet the characteristic differences were kept clear. Her mother believed on the 405th day that she recognized a barnyard cock from a picture in her book; and certainly a few names learned from pictures, as cow, were easily and without surprise transferred to the real object.

Apparently human features in pictures were not as easily recognized as flowers and animals. At a year old she possibly knew in a general way photographs of babies, for she would kiss a new one without suggestion; yet I saw her kiss the *back* of the card once, 365th day. In the thirteenth month, she wished to be lifted to kiss the Raphael cherubs, took especial interest in the portraits on the wall, could point out their eyes and hair, and knew Whittier's by name and preferred it to Emerson's; these, however, were life-size or more. In the fourteenth month, 402d day, she managed with some help to identify the Whittier portrait with a small copy of the same. Three days later she recognized her father's photograph (the face scarcely more than one-fourth inch in diameter), grouped with eight others; then after hesitating and being asked many times, her uncle's. In cabinet photographs she pointed out four other members of the family. None of these photographs had ever been shown her before. Early in the eighteenth month she recognized as a “lady” a dim reproduction in an advertising pamphlet of a vignette photograph, and showed it to us with interest.

After her identification of the first few objects in pictures in the eleventh and twelfth months, she began in the fifty-third week

to ask to have them named, turning over the leaves of her book and putting her finger on one after another, then looking up into our faces with an asking sound. She pointed not to pictures as a whole, but to individual objects in them, the same each time, those that had attracted her interest; now and then a new one would catch her attention, and would be added to the list.¹ Throughout the thirteenth month this was her chief indoor interest, and afforded her singular pleasure; she would bring the book to her mother, grandmother, or me, begging for such an exercise, and would be happy in it sometimes for twenty minutes. In the fifty-sixth week having been told, by way of amusing her, the noises made by the various animals in the pictures, she would, after asking and being told the name of each one, continue to point and urge until its note was given. At the end of the sixteenth month, she would go through the book, naming the pictures herself, usually by these notes,—“moo” for the cow, etc.

In the latter part of the eighteenth month, she had a recurrence of especial interest in pictures, which lasted more or less through the twentieth month. The 528th day, turning over a picture book, and coming to a page of text, she put her finger on it, and said decidedly, “Read!” then on a picture, saying, “Picture!” Anything not text—any decoration, or conventional figure—was a “picture.” Turning over the leaves and naming the pictures as she came to them, she would say, “Picture,” if she came to an unknown one. Seeing a book she would ask if it contained pictures, “Picture?” When pulling down mine and piling them on the bed, she would stop from time to time, sit down and open one, and examine it: “Picture? . . . Find? . . . No?” In the middle of the nineteenth month, at sight of a picture of a bird, on the 561st day, the interest in pictures narrowed to an almost exclusive desire for pictures of *birds*, which was for some days a passion; and for weeks to “see birdy in book” was a frequent appeal. She had other favorites, however, usually pictures of animals and children.

Her interest in pictures during this second period of fondness for them was far more complex and intellectual. The picture sug-

¹ In this way some names were first learned in pictures; but where possible I would always follow up the picture acquaintance promptly by showing her the real object, which greatly increased her interest.

gested not merely the object, but much associated with it. Thus in the eighteenth month, 537th day, having picked up a pamphlet, with the remark, "Book," she sat down on the stairs saying, "Read," discovered a small advertising cut of a dog on the back, and commented: "Dog. . . . Bark. . . . Wow-wow-wow-wow-wow!" She stopped to laugh at her imitation, then: "Muzhik. . . . Bark. . . . Wow-wow-wow-wow-wow! . . . Ruth." (That is a dog. He barks. He barks thus, etc. Muzhik also is a dog. He barks. He barks thus, etc. Ruth too can do it.) Two days after, seeing a picture of a bell, she asked, "Ring?" In the nineteenth month she showed that she understood the *action* of pictures. The 564th day she commented on a child digging with spoon and pail, "In bucket" (Puts the dirt in the bucket); and on a boy with hand in his pocket,—being asked where his hand was,—"Get purse." A more complex comment, but probably based on former explanations, was on the 603d day: "Ducks.swim on water. Old hen."

By the time she was twenty months old her greatest enthusiasm for pictures had passed, though she has had a moderate liking for them since, especially in connection with interesting description or story. By this time, too, her understanding of pictures was practically complete.

As to the understanding of other representations, the earliest ones that came in her way were toy animals and dolls; and the first sign of any relation observed between them and the objects they represented, was that when her first toy cat was given her, at thirty-three weeks, her demonstrations toward it were like those toward the real cats; I thought, however, that this was due to the hairy skin more than to any observed likeness in form. On her first birthday, she was given a new doll, the old one having been for some time broken; the eyes of this doll seemed to interest her, and she felt and examined them with curiosity; told to kiss the doll, she kissed its face properly enough, yet afterward presented the back of its head for someone else to kiss. Christmas day, which fell in the middle of her fifteenth month, she cried "bow-wow" at once on sight of a rubber dog, and imitated a mew at sight of a toy kitten. She had doubtless understood for some time then what her toy animals were

intended to represent. I have a good many notes upon her behavior to her dolls, but will not enter them here.

In the sixty-ninth week occurred a curious incident, which comes under the present topic as nearly as under any. Being in a dimly-lighted room with me in the evening, she suddenly cried eagerly, "Eye! eye!" pointing out of the window to the sky, where two planets (Jupiter and Venus approaching conjunction) stood close together. It was a striking instance of her quickness to see resemblance and her neglect of difference. On the 497th day, as she sat in my lap, she suddenly began pointing and crying, "Baby! baby!" As I saw nothing that could suggest it, I put her down, saying, "Show aunty." She ran to the tray that held the hearth utensils, and showed me in the moulding of its back a conventional ornament shaped by chance with a rough likeness to a human figure. Later in the day I told her to show her mother the baby, and she came at once from the other side of the room and pointed out the same ornament. The 559th day she was amusing herself by bumping her chin with the handle of a large bronze bell, and did it a little too hard; she broke out into a wail about the "mom," which I made out to be a complaint that the "man" had injured her, the handle being a quaint little figure, not very obvious as such. The 563d, she plucked at tufts of red zephyr with which a quilt was adorned, calling them roses; pulled out a scarlet shred, saying, "Leaf," and struck it on her hand, saying, "Snap." This she repeated; and several times afterward recurred to it. I could not make out whether she really supposed the tuft a rose and the shred of zephyr a leaf that could be snapped, or was making believe, but I thought the latter. She accepted at this time with pleasure the shadow "rabbits" her grandmother made her. Her recognition of the first statue she had seen, the 597th day, as a "white man" (it was in fact a female figure, partly nude) has been mentioned.

In all her behavior toward pictures and other representations, I was chiefly struck first by the ease with which the general purport of such things was accepted, after it had once dawned on her,—the primitive stage of development, so to speak, at which pictures were comprehensible and interesting; and next by the extent to which outline made up the representation, and the small part played by

size, color, or even the shading to imitate solid form. We were never able to see that there was any distinct preference for colored pictures over uncolored, and those first recognized were very much in outline; before the eighteenth month she recognized at once as a cock an impression not a quarter of an inch long on a white stamp or seal; in the nineteenth month she was especially interested in some old-fashioned children's books with their small, crude woodcuts, and little advertising cuts pleased quite as much as fine colored plates. It surprised me that she recognized trees and flowers very early, even slightly indicated in black and white,—the color plays so much part with us in the idea of trees especially. Analogous to this was her calling little seedling trees "tee" at first sight, as she did in the eighteenth month; yet the word had been learned in connection with large branching trees. In the same month, 539th day, she pointed to a twig of pink Japanese maple in a glass, crying, "Tee!" and added, "Bā!"—a tree in a vase. Here was neither color, size, nor surroundings to fix it as a tree; yet in a sense, in her absence of knowledge as to what a twig was, she was right enough. The only instances in which color seemed noticed more than form were a disposition about the eighteenth month to confuse her aunt's house and a neighbor's, quite different in form and surroundings but of somewhat similar color; the recognition of *individual varieties* of flowers in colored plates only, as noted above; on the 586th day a failure to recognize an actual flower thoroughly familiar (a sweet pea), in a novel variety, quite different in color from those that she knew; and the recognition of an orange-shaped lemon, mentioned above under Color.

The roughness of resemblance necessary for recognition—the mere suggestion required—struck me over and over. This was analogous to what I observed both as to form and color, and seemed a consistent trait of all her sight recognition; it coincides also with what I have observed of other young children, and repeatedly heard from those who have them in charge.

9. Interest in Seeing.

Up to the 25th day, though the baby doubtless experienced a certain comfort in lighted surfaces or bright points, there was nothing I could call interest; on that day her former staring at faces assumed an appearance of attention and effort, and a still livelier look was called to her face by a surface of lighted color, as noted above. Thereafter till the fourth month, faces were the objects of her almost sole attention; in the fifth week she began to smile in gazing at them; I first saw this on the thirty-second day, and was told that she not only smiled but chuckled in gazing at her father's face the same day. From now on her gaze was constantly fixed on our faces as we talked and played with her, sometimes with demonstrations of intensest interest, panting breath, movements of hands and feet, and occasional smiles. How much of this interest was excited by face and how much by voice I cannot say. On the forty-second day her mother saw similar demonstrations over a spot of sunlight on the white spread, but I never saw them over anything but faces till the third month, sixty-third day, when she showed like excitement over strips of color; but there were instances of an earnest gaze at color in the meantime, as mentioned above.

In the fourth month, besides the interest in faces, and the few incidents of interest in objects related above, especially in daffodils, looking about the room became very absorbing. This looking about, begun early in the second month, had come toward the end of the third to be accompanied by a look of surprise. This surprise now became very striking. Held above one's head, instead of showing gayety, the baby would look around silently, as though absorbed in the novel appearance of things (fourteenth week; but a photograph of the seventh month shows something of the same expression when thus lifted up). She would *inspect* the familiar room for many minutes, looking fixedly at object after object, till the whole field of vision was reviewed, then turn her head quickly, and examine another section; when this was done, she would fret till carried to another place, and there renew her inspection of the room in its changed aspect, — all this with an expression of surprise and

eagerness, eyes wide and brows raised. The window and its outlook were included in these surveys. The habit was striking from the fourteenth week through the seventeenth, most of all in the fifteenth; it then declined, but would recur in a new room. Thus on the 141st day and about that time, taken into the kitchen she would look out of the window, then whirl round to look inside, and wish to be taken to different quarters of the room, just as earlier in the more familiar rooms. During these inspections occasionally an object, as sunshine on the carpet, would attract special attention, and even excite to movements of arms and panting. Yet after these close surveys for weeks, she would occasionally discover an object, as 119th day, a pink and white fan that had long hung in a corner, apparently for the first time.

Outdoors till near the close of the seventeenth week she gazed happily around without fixing her look on any object; on the 119th day, she leaned forward to see me pluck something, and thereafter soon learned to watch objects outdoors as in, but never showed the surprise and curiosity.

After the fifth month, though she continued to look about with interest, the surprised look, eager staring, and quick turns of her head were rare. The inspection of her surroundings with more or less look of surprise, was usually renewed in a new room, or an old one from which she had been for some time absent; and late in the sixth month (173d day) when I took her into the tankhouse and woodshed, places unlike any she had seen before, the look of extreme surprise, even astonishment, jaw dropped, eyes wide, and quick, eager turns of head, were as noticeable as ever. I stopped by a glass door to let her look out; she stared happily for about ten minutes, and when she saw her mother pass, going into the garden, and when two of the family passed through the shed behind her, she looked at each, turning her head and following their movements with deep attention. I then instead of carrying her back into the familiar room as she had come, through the kitchen, stepped across the veranda and re-entered by another door; it appeared to surprise her very much to find herself back there, and she would pay no attention to anything else till she had examined the room and everything in it as if it were novel.

During the third and fourth month, and I think until she had

begun to roll about, when laid on her stomach, she always lifted her head high, and gazed around with a pleased and interested air, as if she saw things in a new aspect.

So incessantly was she occupied with some activity in seeing that when on the 131st day I found her lying happy and wide awake, *not* looking at anything especially, I thought it worth noting; still I do not suppose it could have been by any means a solitary instance.

In the fifth month, while grasping to some extent displaced her interest in looking, her attention to those things that did catch her eye was more persistent and absorbing; 133d day, she caught sight of a brass caster on a chair, and remained gazing at it so fixedly that she could not be induced to resume nursing; her mother would bring her face to the breast and she would turn it back to stare at the caster. Finally her mother changed position so that the baby lost sight of the attractive object, and after looking about, at the fire, the high light on the coal-hod, etc., she consented to nurse again. She was interested in her toes when they were showed her, and looked for minutes from one scarlet-tipped sock to the other. She watched people and things long and earnestly; 134th day the whole process of setting the table, and later of clearing it, without a deviation of attention; the bobbing of her little shadow head on the wall, when her mother began to put her to sleep; 136th day was all the morning perfectly content to sit watching us hurry about, arranging rooms for guests; during the whole presence of one guest, whose attentions pleased her, the baby watched her, hardly having eyes off her, perhaps a half hour. When thus absorbed in looking at anything it was almost impossible to divert her.

The next week—the twentieth—her desire to seize interfered with her willingness to gaze long at anything; when the table was cleared, she desired the articles, and wished to get hold of her toes as soon as she saw them. On the 141st day, however, she sat about half an hour at the window watching the Chinamen as they dug a trench, and other sights; and so at several other times. She was always interested in movements to and fro, especially if there was any bustle. The 158th day she sat for an hour without attention from us, playing with papers and watching us clear out and assort a closet of them. The sixth month, 175th day, *e. g.*, she

gazed awhile at her uncle writing, at her grandmother sorting eggs, then became absorbed in the Chinaman washing dishes, and stared at the process in breathless silence about fifteen minutes; when he left the dishes to take away her bath, she followed him with her eyes, so I carried her after him, and she watched him as he went through two rooms and carried out the bath, watched him through the windows while he emptied it, watched him back to the kitchen, and for some minutes longer as he washed the dishes.

In the twenty-third week, she would lie and look pensively at a bright screen, *e. g.*, and talk to it.

In the second half-year, her pleasure and interest in seeing was so complicated with other growing bodily and mental activities, that I will mention here but a few instances of the simpler sort.

From the seventh month through the year, the sight of animals interested her exceedingly; this was, however, complicated with a desire to seize. 199th and 200th day she was laid on a bed that had a high head with moulded figures; these held her gaze a long time.

In the eighth month, absorbed and attentive watching of new processes was noticeable,—*e. g.*, thirty-second week, lighting the lamp (this interest was, however, stimulated by her father). In the thirty-third week, a Chinese toy, containing a moving turtle, caused for some days an especial interest, even to excitement.

In the ninth month, wheeled in her carriage into new places, she was serious and deeply attentive to what she saw, though a little afraid (249th day); 257th day a spot of sunlight on the ceiling excited a marked demonstration; 265th, she first looked up of her own accord to notice branches swaying in the wind, with surprise and interest in her expression; 271st, on a yacht, once looked over the side to watch for a little time the foam running by.

Tenth month, 281st day, she discovered with a cry of joy and pointed to the sunlit tops of trees, perhaps forty feet tall and fifty feet away, and later (292d day) when on the lawn, she pointed from time to time to the tree tops, especially when yellow with the low sunlight, exclaiming with pleasure. On the 286th, she chanced to look where the sunlight brought out gilt figures on the ceiling; she smiled, pointed, then lifted both arms prettily toward it with laughter and joyous exclamations; again on the 293d. During most of this month, she took great pleasure in standing at the window and

looking out. She followed movements, *e. g.*, sewing, with visible care and curiosity. When carried about the garden, she was satisfied after being given a few flowers, and then was happy to be carried on, looking at her flowers and at the bright beds, crowing, murmuring, and laughing quietly with satisfaction; 285th day, delight in engines, especially in near approach, was first noted; this became a rapturous joy; and gave noticeable pleasure as late as the twentieth month. At just ten months she watched quietly, without offering to touch, but with absorbed attention, sitting on my lap, while I sealed and stamped letters.

In the eleventh month, interest in the sights seen when driving, which had for weeks been growing, became very marked and joyous; she would nestle to us with murmurs of joy, give small shouts, lean to look at objects, utter syllables in joyous tones, smile and look up into our faces, clap and wave her hands; 317th day, from the bed in an upper room, she looked out of the window at a little distance, and overflowed with ejaculations of happiness at the spread of flowers and moving sunlit branches. Again, set down on the floor, she looked out at the tops of walnut trees, now alone visible, sunlit and moving, and cried out again and again with joy. She was much interested in looking down on her uncle from the window, and so thereafter. Her joy in standing at the usual window downstairs continued: she would stand, watch, and laugh; the gardener would go by, occasionally the dog,—for the rest, she watched the trees, flowers, and birds. The 325th day she noticed a brown and white silk sofa pillow, pointing and reaching up toward it with many expressions of admiration.

Part of the twelfth month she was absent, and my notes are meager; in the fiftieth week she was deeply interested for a few days in watching the almond huller, but soon wished to get hold of and pull about the hulls.

Of course there were all this time innumerable instances of interest in objects; these quoted come the nearest to simple interest in *seeing*; and in many of these the intellectual element is considerable. In the looking on while things were done I saw from the tenth month a clear curiosity and effort to understand in her look and manner; and from much farther back this feeling must have been gradually increasing.

In the second year, while her interest in sights multiplied, it is still more impossible to separate it from more distinctively intellectual interest. The pleasure in gazing at the moon already related under Fixation, was a comparatively simple one. The principal interests falling even in part under the head of Sight during most of the second year, have been described under Color, Form, and Pictures. Most of her occupations were active, not receptive. I note in the twenty-first month that to sit without an occupation, merely looking about, even in a new place, seems impossible to her, though sometimes—rarely—she will remain still some minutes absorbed in a special sight. In this month, being once on the city street, she stared a good deal in at windows, and liked to stop along the streets to see what was to be seen. As an example of the rare instances of silent attention, in the twenty-third month, 691st day, she was silent, watching the men unload drying frames, perhaps five minutes, then went to see them dipping prunes, and watched in silence perhaps twenty minutes, then began to examine, comment, and touch.

Her own consciousness of the act of seeing, as shown by her use of words, may here be spoken of. The first one she showed clear evidence of understanding was *look*, in the sixteenth month. She understood a number of verbs then, and if asked, "How does Ruth eat? walk? cough?" would illustrate. The 503d day I said to her idly, "How does Ruth *look*?"—when to my surprise she ran into the middle of the room, and thrusting head and body forward, chin up, bent a dramatically exaggerated gaze before her. This experiment was repeated several times, with the same result. Within the month she began to use the word. The first time I heard her use "see," was in the eighteenth month, 522d day, when she shouted with joy at going out to see the moon, "Moo'! . . . 'Ky! . . . Baby! . . . Shee!" Her mother had heard it at least a week earlier. She had certainly understood both *look* and *see* long before she used them. They did not come very early among verbs, for over thirty of these were used before any verb of seeing. In the twenty-first month, 613th day, as she stood and watched a butterfly, she looked at me earnestly and said, "Wa," repeatedly; I could not interpret it except as "Watch,"

probably referring to a story often read her in which a boy watched a bird.

Three days later, asked, "What does Ruth do with her eyes?" she answered, "Look." As this answer had never been taught, or suggested in any way that I could learn, it is evident that she had by this time referred the sensation of sight to her eyes; or at least had become conscious of directing her eyes toward objects in order to see them, for observe that she said "Look," not "See."

10. Interpretation.

In adopting this heading from Professor Preyer, I have not used it just as he does. I wish to include here only those simplest interpretations by which we translate our bare sensations of sight into intelligent seeing, and not those in which some significance of a sight is perceived, through association and inference—as when the sight of a cloak and cap, *e. g.*, wakes expectation of going out.

Of such fundamental estimates of direction, distance, form, relations of bodies in space, etc., many instances have been given already in connection with other topics. Some comments and additional instances follow.

The striking examination of a room from different quarters, as if to comprehend the changes in distance, relative position, and form of objects, was the earliest noticeable effort at interpretation,—very interesting to see, and giving a curious hint of the immense amount of such cerebral work necessary before the world can take orderly shape to a baby's sight. Preyer suggests that the length of a child's arm must be its first measure of distance; I should not say so, for even before it can seize it has repeatedly had opportunity to measure the distance across the room by being carried to or from objects whose appearance it is familiar with; it sees them in every possible position and at every distance, and in the case of my niece these changes were viewed with the intensest curiosity and effort to comprehend them in some fashion. Again, this has a bearing on Froebel's suggestion that the regular training of the sense of form should be begun with the young infant by the systematic move-

ments of forms before it in the order of geometric simplicity; the fact that the child of its own accord, as it is moved about the room, takes a vast number of observations on the complex forms of furniture, etc., and most of all on the living forms about it, as they advance, recede, turn, seems likely to defeat the purpose of inducing it by systematic degrees into the conceptions of form. These spontaneous observations did not begin, however, in the case of my niece, till the fourth month, and might perhaps be anticipated in the third by more systematic observation of simpler objects and movements.

In the fifth month, 132d day, I swung the baby on my foot, and as she had then begun to look to our faces for sympathy in pleasure or trouble, she looked up to her grandmother, who sat beside me; and as I sat a little to the rear, saw the back and side of her grandmother's head. Her face took on a puzzled look, and she watched the head with great steadiness till her grandmother turned and made some sound to amuse her. This she received with a look of great surprise; her jaw fell, and her brows were raised; and this was repeated several times. I then began to swing her on my foot again, and at each pause she would gaze up at her grandmother till she turned and did something to amuse her, then would be satisfied. I thought from her behavior that she was puzzled to identify the part of the head she saw with the face she expected to see when she first looked up, having known her grandmother was beside her when we sat down. This also suggests that when she gave up her eager study of a room grown familiar, it might have been because she had become able to identify the principal objects from any side. About a week after she was so puzzled by the back of her grandmother's head, 141st day, I came up behind her grandfather's chair with her in my arms, and looking down at the top of his head, she set up a cry of desire to be taken, apparently knowing him from that point of view without hesitation.

The sense of touch was not used to supplement that of sight in investigating the properties of bodies, until grasping was very well established; the first desire to touch and hold objects seemed vague and instinctive, but from the middle of the fifth month to the end of the year, there was a growth in disposition to use the senses jointly, with more and more definite curiosity and investigating spirit.

Some interpretations as to place and direction more complex than those already mentioned, follow. The disappearance of people from a room, and reappearance outside the window, seemed to cost her much perplexity; the first time I noticed this, was near the end of the fourth month, when from a place that commanded view of both inside of door and outer step, through a window, she watched her grandfather disappear and reappear on the outside, with a look of great surprise (119th day). This was two weeks before the incident related above (page 23) of her correct estimate of the place to which I might be expected to have moved across the room, but that was a simpler case; in this, the intervention of the door and wall, which apparently closed the view, was the puzzle.

Early in the 6th month, 156th day, she desired some flowers in her mother's hand, and to hide them from her, her mother tucked them under the carriage blanket at her feet; but the baby seemed to know where they were, and leaned forward, plucking at the blanket and complaining. Yet it was the tenth month before she became habitually able to trace up objects which she had seen put out of sight.

Late in the sixth month, 175th day, in another room from the one where she had become somewhat familiar with the passing of people through the door and reappearing outside, I was surprised to see her turn to the window to look for someone who had passed out of the door as she watched him; then, as he passed that window, to the next one, as if understanding that he would pass by that. I concluded that this was pure inference from experience, for a week later, the last day of the sixth month, she turned and looked expectantly from the window on seeing her mother leave the room by a door on the *opposite* side, which led upstairs. In the eighth month she seemed to understand clearly where people would be seen when they had passed out of the door first mentioned, and turning to look, or waving adieu, became habitual; but at no time in the first year did her understanding of the other doors and windows seem to be clear.

Her experience in the woodshed late in the sixth month (page 80), made a very heavy demand on her sense of locality and direction; and her deep attention to familiar persons moving in part in places not unfamiliar, but seen from a new quarter, and most of all

her surprise in finding that a new road from a strange place brought her into the old room, shows that she had some sort of preconception of local relations, however vague, to be jarred. The experience is one that, in a more definite psychological form, I can parallel from my own memory.

In selecting the foregoing notes from my record, I have excluded much that relates more or less nearly to Sight, wishing to keep as nearly as possible to the subject of the mere sense perception, and the closely related eye-movements, interpretations, etc. It is absolutely impossible, however, in recording incidents as they occurred, to preserve a rigid classification of topics, for the growing powers of the child show themselves all together in the most complex manner, especially after the first year.

MILICENT WASHBURN SHINN.

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DEVELOPMENT OF A CHILD

II

DEVELOPMENT OF THE SENSES IN THE FIRST YEARS OF CHILDHOOD

BY

WASHBURN SHINN

UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

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MILICENT WASHBURN SHINN

**PRESS OF
THE NEW ERA PRINTING COMPANY
LANCASTER, PA.
1908**

EDITOR'S NOTE

The contents of this volume form a continuation of the studies by the same author, published in 1893-1899 under the title *Notes on the Development of a Child* as Volume 1 of the "University of California Studies."* This volume may be considered as forming Volume 2 of the *Notes on the Development of a Child*, although published as Volume 4 of the University of California Publications in Education. References herein to Volume 1 of the *Notes* are distinguished by the Roman numeral I preceding the page number.

* Now merged in the University of California Publications in Education.

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THE DEVELOPMENT OF THE SENSES IN
THE FIRST THREE YEARS OF
CHILDHOOD.

INTRODUCTION.

I. SOURCES AND PURPOSES OF THIS STUDY.

My original data for the following study have come almost entirely from a journal of the development of a single child, who was closely observed by me during the whole period of the record. But in the later examination of the data, I have supplemented them with the observations of others: indeed, I have at some points rested more on these than on my own,—either because at such points my notes were insufficient, or because the facts had been so well established already that my observations could do little more than corroborate. I have, therefore, incorporated in the course of the following study so much review of the work of others that I have not thought anything would be gained by prefixing here a summary of the literature of the subject, to define the status of knowledge from which my own inquiry sets out. So, too, I omit any special acknowledgments here of indebtedness for material and suggestions, because I shall have frequent occasion to render these in the course of the following pages.

My record was but little guided by any previously formulated theory, or by the effort to solve any previously formulated problem: I waited rather for the facts to define the questions as well as to suggest the answers. On a few specific points I formulated questions, and sought answers by experiment; but in the main, I aimed only at a scrupulously objective record of the facts of development, as they appeared quite spontaneously. In my own study of this large mass of biographical facts, I found it neces-

sary to group and regroup them, and to compare them over and over, in different aspects and in the light of different theories; but for purposes of presentation, it seemed to me most useful to gather them under topical divisions, such as were most simple and obvious, and most convenient for reference and comparison with the data reported by other observers; and to reserve my generalizations and inductions for separate presentation. I have, therefore, some time ago, gathered out all my data relating to the development of the senses, classified them, and published them, in several university studies (Notes on the Development of a Child, Numbers I-III, University of California Publications in Education, Vol. I, 1893-1899; in which is included also Number IV, 1899, containing data on the Instinctive Movements, since I found it impossible to consider the development of Sight and Touch apart from that of Grasping). In the following study I now offer my summary and interpretation of these published data,—to which I shall refer throughout, as an integral part of the present treatise.

It is the purpose of this interpretation to trace the development of the senses from stage to stage, with reference to the genetic relationship of these stages, and the process by which each unfolds from the preceding; to see if any general law of this unfolding can be detected; and to consider the bearing of any results thus reached on current problems of psychology. Finally, I formulate the pedagogical conclusions that seem to me suggested,—treating them rather as corollaries than as the objective point toward which the whole study is directed; and this not because I would put the pedagogical application of child-study in a place of secondary importance, but rather because I am convinced that pedagogy itself suffers from an attempt to bend our investigations directly to its service (especially in considering the period of infancy), at this stage of our knowledge. Child nurture already rests on an empiric basis which the very fact of the progress of the race shows to be on the whole sound; and to disturb a sound empiricism with the incomplete conclusions of a new science is dangerous. It is desirable that child psychology should make further advance as a pure science before it ventures

any but the most cautious incursions into the field of applied science.

II. METHODS IN CHILD-STUDY.

1. COMPARATIVE AND BIOGRAPHICAL METHODS.

In studying child development, one may select a definite point of inquiry, and obtain parallel data concerning it from a number of cases,—as Genzmer, for instance, tested some 20 infants for temperature sense by touching with an ice-cold iron rod; or one may keep a consecutive record of the process of development in a single child,—a method of which Prof. Preyer's work is the classical example. By these two methods, which may be called the comparative and the biographical, we have obtained all our important first-hand data for the study of childhood. It is true that fragmentary and unclassified observations, gathered from sundry sources, and compared by a competent student, have given rise to important studies; Prof. Sully, in especial, has classified and interpreted such data with singular felicity. But we cannot count this as a third method in direct child-study, for in the first-hand observations on which it depends there cannot be said to be a method at all.

When the number of observations is large enough, and the data simple and precise enough, to give value to arithmetical averages, the comparative method becomes a statistical one,¹ such as has been largely used in America by Pres. G. Stanley Hall, Dr. Arthur Macdonald, Prof. Barnes, and others. It is rarely possible, when the observations thus pass into the thousands, for the investigator to make them all himself, and in most cases statistical studies rest on data gathered either through assistants or by means of syllabi.

At first thought, the comparative method, especially when it is carried on to the extent and precision of statistics, seems the more scientific one. Conclusions cannot be securely drawn, it is felt, from observations on a single child: individual peculiarities might be mistaken for general traits of infancy. On the other hand, it is evident that the ontogenetic process, the unfolding of one stage of growth out of another, the evolution, in short, of the

¹ Dr. Macdonald gives this the name of the "collective method."

human being, cannot be traced except by watching the successive steps as they actually take place in one and the same child; and during the period of infancy, when this evolutionary process is going on with great clearness and rapidity, it is the most important object of inquiry.

Nor are the data obtained by the biographical method, at this period, wanting in general applicability. For the earliest years of life are mainly occupied with the great generic developments, common to the human race: the fundamental sense powers; the instinctive human types of movement and balancing of the body; the elementary processes of mind; the simplest and most universal forms of emotion. The possible range of individual variation is small, for all normal infants must come into possession of the same fundamental human powers, and by a course of unfolding that is essentially the same.

In respect to practical convenience, too, we are driven to the biographical method in studying children not yet out of the nursery; for comparative data about such little ones, isolated as they are in their several homes, are impossible to collect on any large scale. We have practically none except from physicians in maternity clinics, and these relate only to the newborn.

When we come to the study of older children, comparative data on a large, statistical scale are easily collected through the machinery of school organization, and at the same time the biographical method becomes more difficult in practice, and less useful in results. The observer cannot follow the child's life consecutively, divided as it is between home, school, and playground; the activities become too complex to be recorded; the evolutionary process becomes slower, and obscured by education and by individual variation; the mental life is more or less concealed by reticence. It comes about thus that almost all our studies of the child of school age are comparative, usually statistical, while those of the child in the nursery are biographical.

Yet it must be added that even in infants there is undoubtedly, within its range, a good deal of individual variation; and this variation is of the greatest importance, since it is the measure of the plasticity of our instincts. Moreover, even in case of a

process of development in which there can scarcely be any essential variation (as in acquiring the use of the eye in space measurement), the observer has to divine what that process really is from slight external indications, and these may vary much in different infants. Therefore, both to check our generalizations, and to get wider basis for interpretation, it is important that any biographical record should be compared throughout with other observations. And once more, there are certain starting-points of investigation (such as finding out the exact equipment in sensibility at birth), and certain positive determinations as to the presence or absence of a given power at a given stage (as of color vision in the first year),—questions where what is desired is to fix a detached phenomenon with a high degree of certainty and generality, rather than to follow out its genesis or its results,—in which comparative observations are indispensable. The biographical method, then, thoroughly checked and corrected by comparison, seems to be the true one for the study of children in the earliest period.

2. OBSERVATION AND EXPERIMENT.

This is a cross-classification, for whether the student uses the comparative or the biographical method, he can hardly dispense either with observation or with experiment. Still, experiment will be principally used with the comparative method, and pure observation with the biographical. For when one wishes to get evidence on a given point from a number of infants, he can rarely wait for the spontaneous occurrence of the particular reaction he is looking for; he must arrange conditions to bring it about. Moreover, for exact comparative results the conditions must be the same for each child, and this often requires artificial arrangement. Under the biographical method, on the contrary, where the main purpose is to follow the spontaneous process of development, experiment must be cautiously made, or it will interfere with the spontaneity. So long as tact is used, however, and the experimental conditions are closely in line with natural ones, there need be no such danger; and experiment is sometimes really necessary. When we desire to know, for in-

stance, whether the ability to follow a moving object with the eyes has appeared, it would be fatuous to wait for the chance occurrence of some object moving at the proper distance, in the proper direction, instead of providing one.

No doubt the possibilities of experiment with an infant are limited. Of modern experimental methods in psychology, that which depends on the subject's own introspection and report of his impressions is wholly excluded. We can use only experiments calculated to bring out reflex or sensori-motor responses to stimuli, and then depend on our own interpretations of the responses. Even this type of experiment is greatly restricted in practice by the child's frequent refusal to submit to conditions, and by the whimsical variations in his attention. Nevertheless, it is my impression that it might be used much more effectively in the nursery than has yet been recognized by psychologists.² Experiment with an infant requires a difficult change of mental attitude in the investigator accustomed to deal with the problems of adult psychology, and to adjust his expectation to adult habits of reaction. In the nursery, where the subject will not conform to the conditions of experiment, the conditions must be conformed to him; which calls for an attention to infantile whims that seems puerile to most scientific men. And not only has the laboratory psychologist a strange "psychological material" to deal with here, but he also finds himself in need of entirely new apparatus, so devised as to fall in naturally with the baby's daily activity, —such, for instance, as the device used by Prof. Baldwin to test the color sensibility of an eight-months' infant. The mere mechanical difficulty of getting suitable apparatus has been a real obstacle to the use of experiment in the nursery by women. These are difficulties due not so much to the nature of the study as to its novelty, and there is no reason why they should not be overcome.

Meanwhile, it is just as well that the subject should wait a

²Prof. Baldwin has already urged this method, which he names the "dynamogenetic," and calls "a new method in child-study;" it does not seem to differ, however, in any respect, from the method more or less systematically used ever since Kussmaul's tests of sensibility in the newborn, reported in 1859.

while for any considerable experimental investigation, and should depend for the present mainly on pure observation. The mass of facts easily to be gathered by intelligent observers without intensive research is still great, and the comparison and interpretation of such facts still inadequate; and until these are better surveyed and analyzed, we lack a sufficient inductive basis for theories to guide experiment.

It may be said that child-study is not a new science, but a branch of psychology, and should easily be directed by the theories of psychologists. Yet as a matter of fact, a deep knowledge of adult psychology has not hitherto proved so good a preparation as might have been expected for the study of infancy; and it remains true that the most solid and valuable contributions to our knowledge of babies, so far, have come not from psychologists, but from physiologists. In genetic psychology, indeed, it may be said that the genetic element outweighs the psychologic, —the conspicuous trait in its subject-matter is a plastic and developing condition, an instability and progressive change; and this is a condition long familiar and deeply interesting to the biological sciences, but only slightly so to psychology as yet. Again, in the absence of introspective self-consciousness in the infant, *mind*, as adult psychology knows it, scarcely exists; the whole type of reaction that must be studied, the whole type of interpretation that must be made, approximate to the purely physiological. On the other hand, the physiologist stops short of the real point of interest in child development, the germination of the higher psychic activities. Neither science at present gives a satisfactory theoretic basis for the study; which, therefore, seems to me to promise the best results if it builds up in the main its own theoretic basis, by (1) gathering a large mass of data by observation and limited experiment under guidance only of the broadest and most well-established principles of biology and psychology; (2) classifying, comparing, and drawing inductions from these facts; and (3) only then bringing them into relation with the more tentative theories of the sciences in question.

I realize that this doctrine would have the investigator end

where he is urged, by one of the most eminent students of genetic psychology, to begin;³ and I do not fail to see the great loss, in guidance to attention, that the observer without a theory suffers. A theory formulated, a question framed, opens the eyes to the significance of facts that would otherwise have passed unnoticed. Yet it is no less true that it shuts the eyes to facts that fall outside the theory, and point off to unsuspected knowledge; and it is this rich suggestiveness of the facts themselves toward which we especially need to keep our minds plastic when entering on a new region of inquiry. Darwin's well-known words as to his own method are in point here, and seem applicable to the present status of infant psychology:—

It occurred to me in 1837 that something might perhaps be made out on this question by patiently accumulating and reflecting on all sorts of facts which could possibly have any bearing on it. After five years' work, I allowed myself to speculate on the subject, and drew up some short notes; these I enlarged in 1844 into a sketch of the conclusions that then seemed to me probable; from that period to the present day [1859] I have steadily pursued the same object.

My own study (as I have said above) followed this method of observation and later induction; and even when interpretations foreshadowed themselves to my mind while I watched the process of development, I held them in abeyance till I could make full comparative analysis of everything in my notes that bore on the question, and could also examine the data of other observers, and the psychological discussions that seemed relevant. I fell upon this method more by accident than by deliberate choice: yet I have not regretted it. I have sometimes found when too late that

“‘Only the psychologist can ‘observe’ the child, and he must be so saturated with his information and his theories that the conduct of the child becomes instinct with meaning for his theories of mind and body. . . . That most vicious and Philistine attempt in some quarters to put science in the strait-jacket of barren observation, to draw the life-blood of all science—speculative advance into the secrets of things—this ultra-positivistic cry has come here as everywhere else, and put a ban upon theory. On the contrary, give us theories, theories, always theories! Let every man who has a theory pronounce his theory. . . . In the matter of experimenting with children, therefore, our theories must guide our work.’” James Mark Baldwin, *Mental Development in the Child and the Race: Methods and Processes*, pp. 36, 38.

for lack of a definite theory I have completely overlooked some aspect of development that I should have wished to observe, or left some point doubtful that a well-arranged experiment would have settled; but I have oftener found that where I had used extreme care to record with accuracy and fulness the actual occurrences, even where they seemed to have no significance, an unexpected significance would start out later, when I came to compare widely separated items in the record; and the fact that the interpretation thus formulated itself, so to speak, without prepossession on the part of the observer, seemed to me to give it greater weight.

The older the child grows, the more the study of his mental development ranges itself under the ordinary conditions of psychological research. And even as regards the earlier period, I speak only of the present conditions of the study, and would by no means exclude the possibility, at any moment, of some epoch-making work which shall supply the lacking theoretic basis, and direct future observations along the most profitable lines. Prof. Baldwin's important book⁴ has failed to do this service, and has left the study of early childhood essentially where Preyer placed it, because it has, after all, no close practical relation to that study: its motive is not so much a working basis for the study of genetic psychology as a genetic theory of mind and personality.

3. PRINCIPLE OF CLASSIFICATION.

When we pass from the consideration of collecting data to that of studying and presenting them, we come at once to the need of some theoretic basis, however general,—some guiding principle, according to which the facts shall be brought into groups for comparison and induction. In the case of data obtained by the comparative method, of course, this basis is already at hand in the original inquiry which directed the observation; so too when data from miscellaneous original sources are brought together into a specific comparative study. But when one wishes to organize the facts given by a biographical record, or to make out from data of all sorts a *general* review of the field of child devel-

⁴ *Mental Development in the Child and the Race*, New York, 1895.

opment, the question of a basis of comparison becomes more difficult. No practical method has so far been found except that of a topical arrangement under the different categories of human faculty.⁵ It is probable that no one has found the method satisfactory. The infant's faculties do not develop, one by one, along separate parallel lines: they begin early to enter into so intimate combination that it is impossible to trace the development of one apart from that of another. Shall we treat a new stage in the control of the eye muscles under the head of Will, of Vision, or of Association? It may be an essential chapter in the history of each of the three. When a baby shows by grasping movements an estimate of size and distance, shall we assign the incident to our section on Sight, Touch, Muscle Sense, Association, Inference, Movement, or Desire? to Intellect, Will, or Emotion? Nor does the difficulty come from the use of these particular categories. Should we abandon them for a physiological classification, say, and divide our material into chapters on the Centripetal, Central, and Centrifugal activities, we should meet the same difficulty. Every entry in the record would come under all these heads. There is no possible classification under analytic headings that does not dismember every incident we would re-

⁵ Following are the classifications used in the four classified general biographies, and in Tracy's review of child psychology:

TABLE I.

Preyer.	Sully.	Hall.	Moore.	Tracy.
I. Senses (under which are classed Emotions).	I. Intellect (under which Sensation).	I. Physical development (under which Movements).	I. Movements.	I. Sensation.
II. Will (under which Movements).	II. Emotions.	II. Psychical developments. 1. Senses. 2. Emotions. 3. Intellect (under which Language).	II. Sensations.	II. Emotion.
III. Intellect (under which Language).	III. Will.		III. Ideas. IV. Language.	III. Intellect. IV. Volition. V. Language.

port; for the actual development we are trying to trace is essentially synthetic.

Yet we must needs analyze, in order to interpret. A chronological presentation of facts, narrating a child's development as it actually occurred, as a whole, would bring us no further than the mere observation did. The chronological order of events must be broken into in studying their significance, for we constantly find the infant's action of one day—expressing as it does some incipient phase of development—meaningless and trivial till it is illuminated by some other action, days or weeks after: bits of the mosaic from far apart have to be fitted together before it is intelligible. Nor can one fail to see that though it is true the child does not develop faculty by faculty, independently, yet these different types of life-activity are from the first and at every stage distinct in him, and must be studied separately. Our subject, in fact, by its nature, demands at once the following of a complex progressive movement in time, and the analysis of the changing complex, stage by stage, into its elements.

One is tempted by the ideal of a treatment based on the chronological order, but pausing as it goes to disentangle each thread of development, tracing week by week the separate advance of each power, and also the interplay of powers, the fusion of simpler activities into more complex, and the differentiation of specialized ones out of generalized, never losing sight of the developing whole, the child. Such a presentation must remain an ideal only: even had we complete enough knowledge for it, the mass of apparently trivial details could never be managed in such a complicated treatment. Yet we have in this ideal a suggestion of the principle that should guide our classification. For it is evident that if such a treatment were practicable, we should have when it was done no new method, but only an alternation, paragraph by paragraph, of topical analysis with biographical narrative,—brought into a unified whole by the guiding idea of *a progressive movement consisting of the integration of simpler activities into more complex, and the differentiation of specialized ones out of generalized.* And under whatever alternation

we find it convenient to turn from one to the other of these methods,—paragraph, chapter, or treatise,—we shall have essentially the same treatment, so long as the guiding idea I have just emphasized is the real organizing principle.

I do not here discuss the validity of this principle—the question whether the significant trait of development in infancy really is this progressive integration and differentiation—because the most important part of the following thesis is a contribution to that very discussion. I may say here that I reached it inductively, as the principal generalization based on my own observations; and that its agreement with the analytic results of several psychologists (notably Wundt) concerning the genesis of complex faculties by the fusion of simpler ones in infancy, as well as the precision with which it ranges itself under the Spencerian definition of a true evolutionary movement, was unexpected to me.⁶

III. ANTICIPATION OF CONCLUSIONS.

The general conclusions that I find indicated by the discussions which follow, are, in brief:—

I. The child is at birth capable of receiving impressions in every department of sense (unless for a short delay in the case of hearing). These impressions are feeble, but have from the first the quality of pleasantness or unpleasantness, and to a certain extent at least their own specific qualities, so that they give varied experience. But the sense condition differs totally from that of the adult, in that central connections are wanting; each sensation is a wholly isolated experience; there can be no proper perception, discrimination, or recognition, no consciousness of space, of objects, or of externality.

⁶ Since this thesis was approved (in a form essentially the same as now published), I have embodied my view of the essential process of development in the first year of infancy in a sketch, called *The Biography of a Baby*, printed in *The Puritan*, in 1899–1900, and in book form by Houghton, Mifflin & Co., in 1900; and during the publication of these papers, I was interested to find almost exactly my own view of the true principle of classification distinctly formulated by Prof. Dewey, in a publication of the Illinois Child-Study Society (1897, II, 17–27).

II. The development of the senses after birth consists somewhat in increasing intensity and variety of sensation within the several departments of sense, but more in the synthesis of sense presentations from different departments, producing a perception of space and of objects as such; in interpretations, especially the elementary ones of size, distance, and form; in the association of sense experiences with voluntary movements, so that the organs can be deliberately adjusted to seek the experiences by looking, listening, feeling, etc.; and in recognition and discrimination.¹ That is, physiologically speaking, it consists mainly in the development of the central associative connections.

III. The sense condition at birth does not correspond to any primitive phylogenetic stage, nor does the development of the senses follow the phylogenetic parallel in the main, though some specific phases of development show such correspondence.

IV. The psychic life of the child centers from the first about the higher senses, especially sight, not the lower. Sight, touch, and the feelings connected with muscular activity make up the bulk of the conscious life, until hearing comes to great importance with the beginning of speech. Taste and still more smell are late in development, and of minor importance. But the organic sensations, though in the background of consciousness, have most important relation to the development of the feeling of self, and to the emotions,—relations that can merely be touched on within the limitations of this essay.

V. The pedagogy of the senses in the first three years should consist mainly in carefully affording the freest opportunity for instinctive development. But deliberate education cannot be altogether dispensed with. The enjoyment of music, the understanding of pictures, and the recognition of colors and plane forms, are the directions in which formal teaching of the senses has shown the best results in this early period.

¹ The representative processes, in all this development, follow close at the heels of the presentative, and are involved most intimately with them in every stage after the first. To consider their nature and growth, however, would carry me too far beyond the scope of this essay; the representative element is therefore taken for granted, noted by its results only, in the complex stages of sense development which I try to trace.

I add a few specific conclusions, which seem important enough to justify the emphasis:—

1. Glitter and chiaroscuro interest earlier and more than color. Plane form is discriminated earlier, and interests more, than color. The first picture books should be in black and white outline.

No certain evidence has been found of the existence of full color perception till well on in the second year, but I found it completely developed by the last quarter of that year.

2. The mouth is at first the chief organ of touch and prehension, and is preferred for touch months after the hand has taken its place in prehension. It is for purposes of touch, not on account of taste associations, that objects are so persistently carried to the mouth.

3. In the development of color perceptions, and in the relation of mouth and hand to touch and prehension, there are strong indications of a parallel between ontogeny and phylogeny.

4. Especially sensitive conditions of general sensation attend the oncoming of sleep, and still more the awakening, and have a marked relation to emotional development.

PART I. SENSIBILITY OF THE NEWBORN.

In this part of my treatise I have scarcely anything original to offer: partly because my observations were scanty, and partly because the ground has already been so fully investigated by others.

The subject was early brought into discussion—as early at least as the time of Locke—in connection with the metaphysical question whether any ideas exist before experience has been received through the senses; and one may glean a good many expressions of opinion about it from writers of the late eighteenth century and the first half of the nineteenth,—expressions of opinion, not recorded data of observation, for at this period there was a wholly inadequate idea of the difficulty of the questions of fact involved, and no one seems to have suspected that ordinary casual knowledge of the ways of infants was not sufficient basis for judging the real condition of their senses. Still, these early notices, though of little value as scientific data, had an important influence in hastening careful study of the sensibility of the newborn. They brought distinctly forward the problems: “At what date does the human being begin to receive sense impressions,—after birth, at the moment of birth, or in prenatal life?” and, “In what order do the different sensations appear?” They called attention to the fact that we are not to assume lightly that an infant’s state of consciousness on receiving a given stimulus is the same as our own. And their very contradictions and uncertainty emphasized the need of accurate special observations on the subject.¹

¹ Kussmaul prefixes to his own study a number of citations from earlier writers concerning the time and order of appearance of sensations. A tabulation of these views (to which I add those of Löbisch), up to the date of Sigismund’s *Kind und Welt*, will give an idea of the confusion of mind that prevailed, as late as the middle of the nineteenth century, on a matter so close at hand, and of so intimate human interest and scientific importance.

With Sigismund's "Kind und Welt"² (1856) we have the

TABLE II.
EARLY VIEWS ON THE ORDER OF APPEARANCE OF SENSATIONS.

Writer.	Time of Appearance of the Sensation.		
	Prenatal.	Immediately After Birth.	Later.
Locke, 1791.		Hunger and feeling of warmth.	1. Sight (sense of light). Order after this hard to fix.
Erasmus Darwin, 1793.	Feeling (sensations of position, muscular activity, touch).	Sight, hearing, smell.	
Bichat, 1800.		All the senses, but giving unspecialized sensations (e. g., taste only, no specific tastes).	
Cabanis, 1802.	Touch, and organic sensation.	Imperfect taste, sight and hearing.	Smell.
Carus, 1808.		Touch-smell, undifferentiated.	1. Taste. 2. Hearing (at about 3 weeks). 3. Sight (5th or 6th week).
Rudolphi, 1823.			Taste, sight, smell, all absent in the newborn. Smell much the latest.
Löbisch, 1851.		General sensation.	1. Sight and passive feeling. 2. Hearing and taste. 3. Smell and touch.
Bautain, 1853.		Sight.	1. Taste. 2. Smell. 3. Hearing (not for several months).
Burdach, 1854.		Sight, and general feeling.	1. Hearing and taste. 2. Smell and touch.

² Kind und Welt, Berthold Sigismund, Braunschweig, 1856. Mit Einleitung und Anmerkungen neu herausgegeben von Chr. Ufer. Braunschweig, 1897.

beginning^a of careful observation, in a newly scientific spirit,—although on this especial topic, the beginning of sensibility, Sigismund contributes little. In 1859, however, Kussmaul^b published the results of extended special investigations upon the condition of sensibility at birth, made in a maternity hospital; and the investigations were repeated by Genzmer^c (1873), and Kroner^d (1882). These successive investigations have settled beyond question the main objective facts as to the reactions of newborn infants to sense stimuli. As far as these facts are concerned, therefore, the following chapters must needs be little more than a re-statement of what was already well established, with but a few minor contributions toward our more precise knowledge of the extent and variety of responsiveness within the several departments of sense.

As to the *interpretation* of the objective facts, however,—the effort to determine what kind and degree of sensation, what psychic life, is indicated by the observed reactions,—we are far from any certainty; and it is for the sake of re-examining the data available, and offering my own interpretation of them, that this part of my thesis is written, in spite of its meagerness in original material.

^a The beginning as far as practical influence on readers was concerned: Darwin's admirable observations were made long before (in 1840), but were not published till 1873 and 1877. Tiedemann's, which as Ufer says, "come properly into comparison with Sigismund's in respect to method," and whose date he fixes at last as 1787, fell so absolutely out of sight that until within the last decade bibliographers could not trace it further back than a French translation of 1863; it was evidently unknown to Sigismund and to his immediate successors. We have evidence of the existence of a treatise that seems to have been based on observation, even before Tiedemann; viz., *Lettres et Observations sur la Vue des Enfants Naissants, Desmonceaux*, 1775. Kussmaul, who had not himself seen it, cites a citation made from it by Rudolphi, in 1823. I do not find it in any bibliography, nor does any recent writer seem to have seen it. It would certainly be interesting to recover this paper, pioneer of all pioneers in the field.

^b *Untersuchungen über das Seelenleben des neugeborenen Menschen.* Adolf Kussmaul, Leipzig, 1859.

^c *Untersuchungen über die Sinneswahrnehmungen des neugeborenen Menschen.* Alfred Genzmer, Halle, 1882 (first published as an Inaugural-dissertation, 1873).

^d *Ueber die Sinnesempfindungen der Neugeborenen.* Traugott Kroner, Breslau, 1882.

The question may be raised here : How far can we assume that the motor reactions observed in the newborn infant indicate psychic life at all? Up to the time that some evidence of voluntary action appears, is it not possible that the arc of stimulus and reaction is completed through lower brain-centers, unconnected with consciousness? It is not possible to make any general answer to this question. Consciousness can scarcely be an essential part of the process in any of the movements of the newborn, since it is quite well agreed that these movements are wholly automatic in type;⁷ it must be at best a mere bystander, taking notes for future use; and it is quite possible that some reactions which we are accustomed to associate with consciousness do take place without it in the newborn infant (pp. 23, n. 18; 34; 40). But the evidence for its presence or absence differs in the case of each department of sense, each type of reaction, and must be examined in detail in the chapters that follow.

This is the place, however, to state generally the sort of evidence on which I rely in determining whether sensation is really present or not. There are two considerations which seem to me conclusive:—

1. Where we see in the reactions good evidence of *pleasure or discomfort*, we are not justified in doubting that an experience, pleasant or unpleasant, has been received. It is true that specific reactions (tending to guard against what is harmful to the organism, or to seek what is beneficial) might bear to our eyes all the appearance of expressions of liking and dislike, and yet

⁷ W. Preyer, *The Mind of the Child: The Senses and the Will* (New York, 1892), Chaps. VIII–XI, XV; *Mental Development in the Child* (New York, 1895), Chap. IV. Cf. also Vol. I of this series, p. 397, *et seq.*, and my *The Biography of a Baby*, Chap. II; and Tracy, *The Psychology of Childhood* (Boston, 1897), pp. 90–92. Anatomically, also, the possibility of voluntary action has seemed to be excluded, since the voluntary motor paths from the cerebral cortex were thought to be not yet functional in the newborn infant. Flechsig's later investigation dates the first medullation of these paths *about* the time of birth (*Gehirn und Seele*, Leipzig, 1896, p. 64): still, the motor impulses proceeding down them could not be of truly voluntary type till memory, desire, and choice had come into play, through repeated experiences. Nor has any more appearance of voluntary action been reported in children born at full time than in premature children, in whom the pyramidal paths are undoubtedly still undeveloped.

be excited wholly without consciousness. But the less direct and specific the reaction in relation to its stimulus,—the more wholly it consists of those diffused and sometimes very subtle movements which in our own case are associated *not with this or that specific stimulus, but with agreeable or disagreeable feeling, due to stimuli of all sorts*, and which have never been detected in cases where there was a strong presumption against the presence of consciousness,—the more reasonable it is to believe that the infant feels, as we do. Thus when the application of quinine to the ends of the taste nerves draws the child's face into what we recognize as the expression of "bitter" sensation, and yet no general signs of discomfort are given, we are justified in doubting whether a true taste sensation has been experienced. When the local reaction is followed by restless movements of arms and legs, and perhaps crying, it becomes far more difficult to doubt that the baby has really tasted bitter and found it unpleasant; yet if these signs followed on an intensification of the stimulus, it is still possible to urge that they may be merely due to a widening of the motor area affected by it, an overflow and diffusion of its purely physiological effect, and may not express discomfort at all. But where the emotional reactions occur *without* the local, defensive ones (where the baby makes a crying face instead of a "bitter" one, *e. g.*), or where the diffused signs of comfort or discomfort occur when the stimulus has not been abnormally intensive, and so not likely to overflow its normal local effect,—in such cases, to question the presence of real feeling, with pleasant and unpleasant quality, would be a pedantic skepticism. No observer of merit has ever raised such a doubt.

2. The evidence from *brain anatomy* is of the utmost importance. If the sensory impulses find functional conducting paths to the highest sensory centers, those of the cerebral cortex, we can have no reason to doubt that feelings of like quality with our own are associated with the central discharge; if, on the contrary, the impulses can pass no higher than the primary centers, in spinal cord, medulla oblongata, or cerebral ganglia, we can only conjecture as best we may, from the evidence of human pathology and that of experiments on the lower animals, how much con-

sciousness may or may not be associated with these centers. At the time that Preyer's great study was made, anatomists had found no evidence that any paths within the cerebral hemispheres were functional at birth. Professor Preyer, therefore (believing wholly, as he did, from the evidence of the infant's behavior, that sensations could be experienced in every department of sense, soon after birth), held that "there are several grades of consciousness, lower and higher, which have different seats,—in the higher animals particularly in the spinal marrow, cervical marrow, and brain";⁸ and the higher consciousness he denies to the newborn child. This position is full of perplexities; and the whole matter is cleared up wonderfully by Flechsig's recent discovery that the cerebral cortex and paths are not wholly undeveloped at birth. According to his researches, there is every anatomical reason to suppose that a limited number of impulses can in fact penetrate to the highest sense centers, and that a number of the reflexes observed in the newborn infant are of cortical origin.⁹

Where we find the child, then, behaving as if it felt a sense-impression, and when it is known to be anatomically possible that this impression should reach the highest sense centers, we have twofold evidence, which gives us practical certainty of the presence of sensations like our own.

⁸ *Mental Development in the Child*, p. 155. See also *The Senses and the Will*, p. 70.

⁹ It may be objected that this whole argument rests too confidently on the assumption that the date of functional capacity in a nerve-path can be fixed by the appearance of the medullary sheath, as if it were never possible for a neuron to transmit impulses without this sheath. It is well known that medullation is not, in itself, essential to function; but where its absence is due (as in the cerebrum of the newborn infant) to the immaturity of the neuron, we cannot suppose that the latter is as yet ready to carry impulses (Donaldson, *The Growth of the Brain*, London and New York, 1897, p. 234). Or if any impulses *could* make their way along the undeveloped, uninsulated paths, to the still more immature cortical cells, they could scarcely excite true sensations, with definite specific qualities; the infant would experience, over and above any few faint definite sensations, a much greater mass of confused and vague feeling—a condition that is not indicated by his behavior (see *General Sensation*, p. 45).

I. VISUAL SENSIBILITY.

1. SENSIBILITY TO LIGHT.

The child that I observed seemed from the first hour to feel a mild light agreeably (I, p. 10).*

That all normal children do react to the stimulus of light, immediately after birth, was already well established. The testimony of observers is practically unanimous.¹⁰ In every one of the numerous cases tested by Kussmaul, Genzmer, and Kroner, the pupil was found to narrow and widen in response to changes of light, and the lids to close convulsively against dazzling light. Preyer says that he never saw a normal newborn child bear dazzling light quietly with open eyes.¹¹

These defensive reactions, while they prove the sensibility of the retina, do not tend to confirm my impression that light is felt *agreeably* at the first. In the case of his own boy, however, Preyer found that long before the close of the first day the little face took on suddenly a less contented expression when the dim light of the window was shut off from the eyes. It is evidently a question of the intensity of the stimulus. The retina of the newborn can bear but a small quantity of light. The pupil, Preyer has observed,¹² is more contracted than in adults; the lids open by but a narrow slit,¹³ and yet with all this pro-

* References thus given are to the author's Notes on the Development of a Child, this series, Volume I.

¹⁰ Cuignet, as quoted by Genzmer, says that the two children he observed spent the first day in continuous sleep, and does not record the reaction to light till the second day; but this, of course, means simply that no opportunity was found to make the observation on the first day, not that negative results were obtained. Mrs. Moore (*The Mental Development of a Child*, Kathleen Carter Moore, New York, 1896) says that in the case of her boy, the pupils on exposure to light on the first day, showed "little alteration."

¹¹ *The Senses and the Will*, p. 5. Cf. also Garbini, *Evoluzione del Senso Cromatico nel Infanzia* (Firenze, 1894), p. 12; and Mrs. Hall, *First 500 Days of a Child's Life* (*The Child-Study Monthly*, 1896-1897, Chicago. Vol. II), p. 458. Mrs. Hall saw contraction of the brows against bright light.

¹² *The Senses and the Will*, p. 4.

¹³ *Op. cit.*, p. 2; cf. also Mrs. Moore, *op. cit.*, p. 51; and my *The Biography of a Baby*, p. 79.

vision for limiting the admission of light, defensive reactions quickly occur against an illumination that is at all brilliant, or even against a moderate one when the pupil has been expanded by darkness.¹⁴

The quantity of light that the retina can receive with comfort seems to increase day by day, and almost all observers mention the infant's contented staring at the window, the lamp, etc., during the first fortnight; or even turning his face persistently toward the lighter side of the room;¹⁵ in some instances crying when light is withdrawn.¹⁶

It is well established, then, that in the newborn infant, the following reactions to light take place:—

1. In all normal infants, on the first day, defensive contractions of iris, lids, and sometimes brows, against bright light.
2. In all normal infants, on the first day or soon after, a general expression and behavior of contentment in mild light, and sometimes of discontent at its withdrawal.
3. In many infants, on the first day or soon after, reflex seeking movements toward the light.

That these reactions are accompanied by *sensations* of light, agreeable and disagreeable (as I have assumed throughout the foregoing paragraphs), is not to be doubted. Even if the simple defensive and seeking reactions might take place without consciousness of the stimulus, we have the stronger evidence of those more complex and refined ones that make up a facial expression and general behavior of content and discontent (p. 19, above). And the presumption raised by the infant's behavior is confirmed in the most decisive manner by brain anatomy, since Flechsig's

¹⁴Preyer, *op. cit.*, p. 6; cf. also Champney's Notes on an Infant, p. 42 of the Talbot papers (Papers on Infant Development, edited by Mrs. Emily Talbot, Boston, 1882); and I, p. 10, of this series.

¹⁵This movement I was not able to see; but that it does often occur in the early days of life is thoroughly established. Sigismund, Kussmaul, Genzmer, and Kroner all report it, and Preyer found it "the rule" with his child by the 6th day. One of the contributors to the Talbot papers saw it as early as the 1st day (Case C, Papers on Infant Development), and Kussmaul on the 2d.

¹⁶Preyer, *op. cit.*, p. 3; Garbini, *op. cit.*, p. 14; Daniels, MS. record.

announcement¹⁷ that conducting paths from the retina as far as the cerebral cortex are found medullated and ready to function in the fully matured foetus at birth. We could not look for more complete evidence (in the absence of a report from introspection) that the normal newborn infant feels the specific sensation of light, with agreeable and disagreeable quality, just as we do.¹⁸

2. SENSIBILITY TO COLOR.

I was not able to find any indication whatever of sensibility to color within the first three weeks. Even after sensibility to light was conspicuous, the most brilliant field of color produced no reaction whatever (I, p. 25).

This is absolutely in accord with the reports of all observers

¹⁷ Ueber die Associationscentren des Menschlichen Gehirns. *Proceedings International Congress of Psychology*, 1896, p. 53.

¹⁸ The question whether the reflex circuit through the lower visual centers alone might involve consciousness of light, is one with which we do not need to perplex ourselves, in the case of the normal infant, born at full time. But the case is somewhat different as regards prematurely born children. Kussmaul saw the reflex turning of the head toward light on the 2d day, in a child born in the seventh month, and Genzmer an adjustment of the pupil to light in one born in the eighth month. But Flechsig states that up to the close of the eighth foetal month the paths from the retina to the cortex are still unmedullated. There is a certain presumption from this that these reactions can take place without consciousness of light, since it is well known that in the older human being there is no light sensation whatever when the cortical center of vision is destroyed. It is, of course, possible that the condition of the infant's lower centers, before the higher have developed, may be more like those of the lower mammals than like those of the adult human being, and therefore capable of mediating some visual consciousness, as seemed to be the case with Goltz's dog. Or it is possible that individual differences exist, and that in some infants the visual paths to the cortex are medullated earlier than in the cases examined by Flechsig. As our present knowledge stands, it is certainly doubtful whether any sensation of light is experienced at first by the prematurely born infant. Flechsig reports, however, that in such infants the cerebral paths become medullated with much greater rapidity, under the influence of external stimulus, than would have taken place under normal conditions, and that they are complete some time before the ordinary time of birth. (*Gehirn und Seele*, p. 53.)

who have given attention to the question of color.¹⁰ In the present state of our knowledge of the physiology of color vision, it is hardly possible to get any evidence from anatomy as to its presence or absence. But we are justified in concluding from the total absence of reactions to color that it is not seen by the young infant; and this presumption is strengthened by the doubtful nature of all the indications of color sense for months afterward (see chapter on Color Sense, below). It is worth recalling, too, how small is the *quantity* of light admitted to the retina of the newborn infant (p. 21),—possibly not enough to give chromatic sensations in any case.

3. ADJUSTMENT OF EYE, AND TRUE SEEING.

It is evident that there can be no real seeing of objects without an elaborate system of co-ordinated movements, by which the eye is directed to the object, and over and about it to take cognizance of its form, and the lenses are adjusted to its distance. Of such movements I saw no rudiment in the first fortnight. The eyes rolled about almost incessantly, in those vague movements which I have called "spontaneous," and have attributed (following Preyer) to mere random overflow of motor stimulus, disengaged by the processes of growth in the centers (I, pp. 180, 299); they were directed to nothing, followed nothing, dwelt on nothing. There was, it is true, a prevalence of symmetrical movement of the two eyes, but there would naturally be an inherited tendency to this, even in the most random movement (I, p. 299). There has just been reported to me by Mrs. Chapman, whose scanty but careful observations I have quoted several times before from her MS. notes, the case of a child born in the seventh month, in whom, therefore, the ability even to see light is doubtful (p. 23, note 18), whose eye movements are remarkably symmetrical. Professor Preyer satisfied him-

¹⁰ Genzmer conjectures that the newborn child receives "no sharp light images, but only general impressions of lightness, darkness, and color." The conjecture seems to have been without evidence as regards color, however; and in his later observations on his own child, he could get no indication whatever of color sensibility before the child was four months old. *Op. cit.*, pp. 23, 24.

self that in this tendency of the eyes to move in approximate unison in the earliest period,—a tendency constantly violated by highly asymmetrical movements,—there is no real co-ordination for visual purposes.²⁰

That there is at this time no seeing of objects, that vision is, as Kussmaul says, "only a dull sense of light and dark, something such as the mole has if he finds himself above-ground," all observers, so far as I know, agree positively. Very few have been able to find, within the first week at least, any sort of fixation, any rudiment of progress toward adjustment of the eye, even so much as a persistent staring at a bright surface placed in the line of sight.²¹ But there are two important exceptions to this rule, which tend to show that the apparatus for some of the visual adjustments is ready in the new born, and can be brought into reflex activity:—

1. Genzmer succeeded in inducing an apparent fixation and following movements with the eyes, and even with the head, as early as the 2d day of life, by holding a glittering key-ring, constantly shaken, before the eyes. That is, by applying a strong stimulus of light slightly at one side of the center of the visual field, the eyes can be made to turn so as to bring the high light to the center of the field. I find contradictory statements from physiologists as to whether the fovea takes on its special characteristics until after birth; but if there does exist a ready-made, inherited reflex by which the turning movement occurs upon the proper stimulus, it would take place in any case, whether better seeing was to be had thereby or not. Genzmer's observation is confirmed by two or three mothers' records (p. 60), but is in opposition to the results of such observers as Preyer, Kroner, and Raehlmann, who could get no following movements for weeks. Genzmer himself failed when he used a candle, and thought that the key-ring, constantly shaken, produced a dazzling effect that supplied a stronger stimulus. In any case, no such

²⁰ *The Senses and the Will*, pp. 34-41.

²¹ Prof. Sully reports a fixed gaze on the 2d day; and Tiedemann thought that his boy's eyes at the same age were drawn toward objects in motion.

movements have ever been reported in the first week except under strong artificial stimulus.

2. Quite different in this last respect is the turning of the *face* toward the light, which I have already mentioned (p. 22),—a movement that makes its appearance under no other stimulus than the ordinary light of the room, falling unequally from one side. It has evidently the same object as the eye-movement; viz., to bring the highest light to the center instead of the more peripheral parts of the retina; and it seems to be indicated as the more primitive and easy way to do this by the fact that it appears in so many children, and without extraordinary stimulus. It does not appear in nearly all, however (p. 22, note 15), and plays no part as a regular stage in the development of the power of directing the gaze, but fades away as the control over the eye-movements increases,—or rather, becomes subsidiary to those movements.

It gives an impression of voluntary *seeking* of light that has been hard for observers to resist,²² but there is really no more

²² Thus Kussmaul concluded that light already "awakened a feeling of pleasure, and caused the child to seek it"; and Kroner says that the newborn keep turning the head "with preference" toward the light. And though Preyer says that the movement "cannot be regarded as a voluntary direction of the gaze," he goes on to explain it as "a case of desire in a primitive form": "Such and such a position of the body or the head is associated with an agreeable sensation"—that of light—"and is therefore preferred; another position, a disagreeable one, in which the face is shaded, is avoided." (*The Senses and the Will*, p. 2.) Such an explanation assumes a voluntary control, if not over the direction of the gaze, certainly over the positions of head and neck, which is quite at variance with all we know—with all that Prof. Preyer himself holds elsewhere—as to the type of movement in the newborn. Nor does it seem possible that an association can be formed so early between the sensation of light and the various dermal and muscular and other sensations that make up the feeling of position. I could not detect any sign of a fixed association before the 4th week; and we should not expect one to appear any earlier, from what we know of brain structure at this period (p. 47).

Sigismund, on the other hand, long before, noted the primitive and automatic character of the movement: "The eye of the nursing soon seeks the place where the light glimmers through the curtains, but in a way to give the observer the impression that it is quite involuntary and passive, as when the plant turns itself toward the light." So also Genzmer, more technically, holds that we have in this apparent seeking, "the be-

difficulty in supposing that an old reflex arc exists between the retina and the neck muscles than in recognizing one between retina and eyelids. It has not the precision and invariableness of a well-established reflex, but we are obliged to recognize in the infant a number of movements that can be accounted for only as imperfect and unstable reflexes,—survivals of ancient forms of action, now superseded by more useful ones, or broken up by the necessity of more varied and voluntary action; or, on the other hand, of forms of action that never became quite serviceable enough to be firmly fixed in the nervous system. A good instance of such survivals is the reflex hand-clasping of the young infant, which fades out as soon as voluntary clasping is developed. There is throughout life a slight involuntary tendency to turn the face toward light that falls sidelong; and possibly in the entire absence of inhibitions this might appear as a distinct reflex movement. The fact that Kussmaul saw this reaction on the 2d day, in a child born before the close of the seventh month, is strong testimony to its wholly automatic, if not unconscious, character (p. 23, note 18).

Even in a fully-developed newborn child, the increased distinctness of vision obtained by the movement can be hardly more, as has been said, than we experience in turning our closed eyes to the light. Preyer has emphasized the fact that the child, during the first weeks, shows no sign of feeling light (of moderate intensity) differently from darkness except when a *large part* of the field of vision is illuminated or shaded,²³ and Garbini confirms this by several experiments.²⁴ In this automatic rolling of the head away from a dimmer field toward a less dim, then, we cannot see anything like real looking, any sense of direction, or consciousness of surroundings.²⁵

ginning of a fixation that comes about through reflex action'' (der Anfang einer auf reflectorischem Wege zu Stande kommenden Fixation). Fixation seems as a matter of fact to develop out of the primitive *eye* movements, rather than out of this neck movement; yet the latter has no doubt a subsidiary part in it.

²³ *The Senses and the Will*, p. 178.

²⁴ *Op. cit.*, p. 15.

²⁵ I recorded in my notes another movement of apparent fixation, still more difficult to explain than the turning toward the light; and as it

No more advanced movements of visual adjustment than these have ever been reported in the newborn. No trace of accommodation to distance has been found before the third week, and even then (as both Genzmer and Preyer were satisfied²⁶) in a merely illusory way, without any real adjustment for visual purposes.

II. AUDITORY SENSIBILITY.

Hearing was not apparent at all till the third or fourth day in my niece. On this day, and for several days after, she started, or even cried out, at the sudden sharp sound of rustling or tearing paper. For the whole of the first fortnight, hearing was nothing more than a weak and variable sensibility to auditory shocks (I, p. 107).

As to the *time* at which this sensibility appears, the evidence is highly contradictory. Kussmaul found that he could make the loudest discordant noises in the ears of newborn infants, without disturbing them in the least.²⁷ Czerney, in his experiments as to the soundness of sleep, was unable to use sound as a stimulus with them, because of their failure to respond to sound-impressions.²⁸ Sigismund held that "the ear is as good as closed in the first weeks," and that it is not till after three to eight weeks that the child begins to shrink at sudden noises.²⁹ Champney's child, during the first week, "would not start at any noise, however sudden, when unaccompanied by vibration of the room or bed," and even at 14 days old he gave no unmis-

remains entirely uncorroborated, I have not mentioned it in the text. This was a persistent turning of the head, from the first day, toward an approaching person—that is, toward a large *dark* body, intercepting the light. I can account for this only as another transitory survival of an ancestral reflex movement. The response by motor discharge of some sort to the approach of a dark mass is undoubtedly a very primitive reaction; and though it usually takes the form of shrinking or warding movements, there is also in the higher animals so inveterate a tendency to turn *toward* a dark mass in the indirect field of vision, in order to look, that we might possibly catch a glimpse of it now and then in the form of a true reflex movement, briefly appearing in the newborn, and fading at once before higher forms of control.

²⁶ Genzmer, *op. cit.*, p. 24; Preyer, *The Senses and the Will*, p. 50.

²⁷ *Op. cit.*, p. 38.

²⁸ *The Psychology of Childhood* (Tracy), p. 21.

²⁹ *Op. cit.*, p. 22.

takable sign of hearing.³⁰ Flechsig found the cochlear fibers of the auditory nerve, at a week after birth, still only beginning to be developed beyond the lower corpora quadrigemina.³¹

On the other hand, Genzmer,³² in thirty careful tests, and Moldenhauer³³ in fifty, using means to produce an extremely loud, sudden, piercing sound near the ear (without jar or air-current) obtained unmistakable slight reactions on the first day, and even in children only six hours old. Mrs. Hall's careful and trustworthy notes record a distinct reaction to sound (that of an electric bell on the outer wall of the house) at *three* hours old,³⁴ and a similar instance is given in one of the Talbot papers.³⁵ Several other observers place the first reaction to sound on the 2d or 3d day, or within the first week.

TABLE III. TIME OF FIRST REACTION TO SOUND.

AGE OF INFANT.	OBSERVER.
Three hours	{ Hall. Case A, Talbot papers.
Six hours	{ Moldenhauer. Deneke. ³⁶
First day	{ Genzmer. Sully.
Second day	{ Moore. Case C, Talbot papers.
Third day	{ Feldbausch. ³⁷ Shinn. ³⁸
Third or fourth day	{ Sharp. ³⁹ Preyer.
Fourth day	{ Tilley. ⁴⁰ Kroner.
Fifth day	{ Darwin.
First week ⁴¹	{ Champneys.
First fortnight ⁴²	{ Catterall. ⁴³
After first fortnight	Sigismund.
Three to eight weeks	

³⁰ Papers on Infant Development, p. 42.

³¹ Ueber die Associationscentren, p. 53; Gehirn und Seele, pp. 53, 106 (Fig. 4).

³² *Op. cit.*, p. 19.

³³ The Senses and the Will (Preyer), p. 78.

³⁴ The Child-Study Monthly, II, 8 (Jan., 1897), p. 465.

³⁵ Case A, p. 12. ³⁶ Reported by Preyer. ³⁷ Reported by Genzmer.

³⁸ I did not myself see the reaction till the 6th day, but it was then very credibly reported to me as having occurred before; and again, as this goes to press, in the case of a nephew, 3d day.

³⁹ MS. record of Mrs. Eleanor Sharp.

⁴⁰ MS. record of Mrs. Laura Sawin Tilley, A.M., Smith College, '92.

⁴¹ This may, however, have been within the first days.

⁴² MS. record of Mrs. Helen Tunnicliff Catterall, A.B., Vassar College, '89, and Fellow of Chicago University.

It cannot be doubted, then, that under extreme stimulus many infants will show a certain responsiveness to sound on the first day of life. No child has ever been reported as doing so in the first three hours; and it is well established that the ear immediately after birth is not in a condition to receive sounds.⁴³

Aside from the question of the *date* of appearance, all observations agree as to the condition of hearing in the newborn. All have found it weak, and several speak of its curious *variability* not only as between different individuals, but in the same child at different times,—a sound is reacted to strongly at one time, and utterly unheeded at another.⁴⁴ Observations agree,⁴⁵ too, that to reach the centers and excite motor reaction, the sound must be of the nature of a sharp auditory shock. There is no sign that the ear takes in gentle sound continuously and with comfort as the eye does light, or that the multitude of sounds, loud and soft, going on about the child, are heard at all; only one now and then seems to have the penetrating power necessary to startle the nerve-circuit into action.

Taking into account the insensibility of the infant to all but a few startling noises, the character of the reactions (quivering of the eyelids, convulsive movements of the arms and head, starting, general restlessness, and finally screaming), and the testimony of Flechsigs above quoted, that the cochlear nerve-paths are functional only as far as the lower cerebral centers, it seems

⁴³“The tympanum at birth is packed with areolar tissue, which only gradually becomes absorbed.” Champneys, in the *Papers on Infant Development*, p. 42.

⁴⁴“The child cannot hear immediately after birth, because a gelatinous substance closes the outer passage, and the middle ear still holds too little air.” Ufer, *Notes in Kind und Welt*, p. 179.

⁴⁵“The outer auditory passage is not yet permeable, the tympanum being set too obliquely.” Preyer, *The Senses and the Will*, p. 182. “There is also to be taken into account as a cause of the deafness of the human being at birth, the temporary closing of the external auditory canal, which is due, according to Urbantschitsch, to absolute contact of the coatings”—p. 75.

⁴⁶I, p. 107; Kroner, *op. cit.*, p. 6; Mrs. Moore, *op. cit.*, p. 63; Tracy, *op. cit.*, p. 24.

⁴⁷For a single exception see a note by Mrs. McLeish, cited on p. 119, footnote.

open to serious question whether the reactions to auditory stimulus in the first days indicate that any true sensation of *sound* has been experienced. Moldenhauer has already raised this question, and conjectured that the feeling experienced may be *pain*, not sound.⁴⁶ With our present growing knowledge of the distinction in function between the canals and the cochlea, it is a more probable conjecture that the infant experiences, through the cortical connections of the canals (connections that seem to be functional at this time)⁴⁷ a certain auditory *jar*, such as we ourselves experience in harsh, sudden noises, underlying the sound, as it were.

It is impossible to guess, of course, how much consciousness of true sound may be mediated through the lower centers, with which the cochlea is already connected; but it hardly seems possible that this could be just the same sort of consciousness of sound as that which we know by means of the cortical center; nor does the infant's behavior indicate that it is.

Whatever the exact nature of the auditory sensations received at first, the reactions all tend to show that they are very dull, but that whenever they are strong enough to have an emotional effect, it is of a disagreeable type, with an element of shock.⁴⁸

⁴⁶ Kroner, *op. cit.*, p. 7.

⁴⁷ Flechsig, *Ueber die Associationseentren*, p. 53; *Gehirn und Seele*, pp. 53, 63, 75. The probability that the centripetal paths from the canals end in a region close to the cortical radiation of the skin and body-interior paths, not in that of the cochlear paths, strengthens the theory that the sensations excited through them are rather of jar than true sound.

⁴⁸ Genzmer (*op. cit.*, p. 20) mentions one reaction of different character. He found in the case of children who heard best that if he struck the bell softly, close to one ear, the head was sometimes turned toward that side. The observation is entirely unconfirmed; but it suggests a curious analogy with the early turning of the head upon visual stimulus (pp. 26-27); as though the deeply-fixed race habit of turning the head toward a sound also made its appearance now and then in the first days of life as an imperfect and unstable reflex, disappearing quickly before higher forms of muscular control, and reappearing later as a voluntary movement. This reaction occurred only when the sound of the bell, though sudden and penetrating enough to act as a stimulus, still fell short of giving intensive stimulus, and was not actually disagreeable. See, too, the citation from Mrs. McLeish, p. 119.

III. DERMAL SENSIBILITY.

(1) *Contact*.—With regard to the baby's sensibility to contact, I made no observation of any importance except that she seemed to experience a feeling of general comfort in being touched and cuddled (I, p. 136). The well-known reactions of sucking and swallowing at the touch of the nipple on lips and tongue, and of clasping down the fingers at a light pressure in the palm, occurred, as in every nursery.

(2) *Temperature*.—As to temperature sensibility, the baby was kept at as constant a temperature as possible, and gave no sign of being affected in any way by such variations as did occur.

(3) *Pain*.—Of dermal pain sensibility I saw absolutely no sign before the sixth month; this was in the absence of special tests, but there is no doubt that the sensibility was extremely low (I, p. 144).

(1) There is no doubt whatever that infants respond readily to *contact* stimuli, sometimes even from the moment of birth.⁵⁰ Besides the familiar reactions mentioned just above, a great number of varied responses to local touches in different parts of the skin were observed by Kussmaul, Genzmer, Preyer, and Kroner, who carried out systematic tests. These tests proved clearly, however (as ordinary observation would lead us to expect), that it is *only about the face*, especially the mouth and eyes, that a fine sensibility exists; over the rest of the body, excepting the palms and soles, the contact sensibility is decidedly dull.

(2) It is also well established that *cold* stimulus calls out lively reactions in the earliest days,—either a moderate cold widely extended over the skin surface, or very cold local touches.⁵¹ Whether warmth is felt as such, or is merely a condition necessary to keep up general organic comfort, I think no one has tested in any way,—as by local heating of the skin.

(3) Dermal sensibility to *pain*, all observers agree, is remarkably low in the first days of life. There has been natural reluc-

⁵⁰ Preyer, *op. cit.*, p. 32; Kroner, *op. cit.*, p. 9.

⁵¹ See especially Genzmer's experiments, in which he tested more than 20 children, by touching with an ice-cold iron rod, and also by wetting the skin and blowing on it. *Op. cit.*, p. 9.

tance to experiment on this point, but chances for observation occur in small surgical operations, and Genzmer ventured to test some sixty babies deliberately with needle-pricks. His conclusion was that in premature infants, and for a day or two after birth in normal ones, the skin has practically no sensibility to pain, and for weeks longer the reactions are in his opinion of doubtful character.⁵² Kroner, however, says that he has often seen distinct pain reactions—crying and distortion of the face—in newborn infants, on strong electrical or mechanical stimulus of the skin, and Preyer points out that while a stimulus of limited extent, like a prick, however sharp, may be ineffective, one that reaches a large number of nerve-ends, as a slap or pinch, always produces reactions from the first day.

In the question how far dermal stimuli are really *felt*, with true sensations of touch, pain, heat and cold, we have a more complex problem than in the case of sight and hearing.

First, as to the evidence from the infant's behavior:—Mrs. Moore and Mrs. Tilley both confirm my observation that from the first day this indicates pleasure in gentle contact.⁵³ I believe it would prove true in every nursery that the infant shows signs of comfort when patted, stroked, or held against one's face or breast; and this can hardly be due to sensations of warmth, which would reach the child but slowly through his wrappings—nor is the body that touches him likely to be quite as warm as his own. It is only in case of a somewhat *broad* contact impression, with soft pressure, that this feeling of content is shown.⁵⁴

⁵² *Op. cit.*, p. 12.

⁵³ Mrs. Moore's boy "ceased crying a number of times when a hand was laid on his body" (*op. cit.*, p. 73). Mrs. Tilley's child "from the first" seemed to enjoy having his head rubbed and his hair smoothed; "he would shut his eyes and look the picture of content" (MS. record). In the case of my niece also it was this somewhat *extensive* contact, with light pressure—a hand laid on the body, stroking, pressing her body or face against ours—that caused signs of content; not mere touches.

⁵⁴ A like contented behavior is always noticed in connection with the sucking response, even where no satisfaction of hunger is concerned; but this, I think, is not caused by pleasure in the touch on the lips that provoked the movement. Perhaps the *continuous pressure* of the object that is sucked is agreeable; but probably still more the sucking movement.

in the tests referred to above, where mere touches with finger-tip, with a warmed glass rod, a feather, or a hair-pencil were used, there is no record that any sign of agreeable or disagreeable feeling was given; and indeed, the peculiarly neutral and indifferent manner of the infant's ordinary touch reactions (as when his hand clasps a finger laid in it) is evident to casual observation. But sensations from light, transitory touches are apt to be neutral in their "affective quality" at all times of life, so that this behavior of the infant is no evidence that the touches are not felt. It is more significant that the acephalous child examined by Preyer, which did not react in the least to light or sound, reacted quite normally to a number of touch stimuli. This is conclusive evidence that in the human infant, as in the lower vertebrates, the primary touch centers *can* act in the entire absence of any connection with the cerebrum; and probably do so act in the normal infant, in the case of many touch impressions,—which could, therefore, be felt only as far as these lowest centers may have a consciousness of their own.⁵⁵

⁵⁵ Flechsig says broadly: "In human beings, to destroy the cerebral sense-centers destroys sensation." (Ueber die Associationscentren, p. 56.) But elsewhere he says, "It is *in nowise* proved that only the gray cerebral cortex can mediate consciousness;" "Feelings and elementary sensations may very well be connected with all the lower brain parts. . . . As the cerebellum shows no connections at all, or highly rudimentary ones, with the higher sense-organs, the consciousness mediated by the cerebellum could have for content only the body feelings, and all sorts of touch impressions;" "Anatomy shows plainly that in the lower brain parts apparatus are given that are able to mirror back from within the whole condition of the body;" while in the cerebral tract assigned to the sense of touch "the body for a second time" and on a higher plane, "mirrors itself in its whole extension." (Gehirn und Seele, pp. 12, 19, 21, 38.)

Whether reactions that are solely dependent on the lower parts of the brain are absolutely unconscious in the human being—or whether there exists, through connections with the cerebellum and *formatio reticularis*, the lower type of consciousness that Flechsig supposes, but which he will scarcely call sensation—we cannot tell; and in neither case would it affect our discussion much. For we cannot suppose that such a lower consciousness would contain the typical qualities, the "specific energy" of the sensations associated with cortical activity; and it is these specific energies that the infant learns to discriminate, to associate, to remember, and out of which he constructs the perceptive sense life whose development we are concerned with.

Unlike touch reactions, those which follow *cold* stimulus always indicate a decided "affective quality" in the sensation—in this case a disagreeable one.

The same thing is true of those which follow pain stimulus, with one remarkable exception: Genzmer found that when infants, at two or three days old, first began to respond to needle pricks, it was not with characteristic pain reactions, but with just such as would follow *contact* stimulus. One might suppose this indicated that while the skin was still insensitive to pain, the mere contact of the needle was felt; but the reactions were clearly distinguished from those of contact by their slower physiological time, and by difference in the location of sensitive spots. It would seem, then, that the paths which belong specifically to pain conductions can be permeable, and yet no specific feeling of pain be excited in the subject. The conjecture follows that in this case the excitations reach only the primary centers, and that it is only in the higher centers that pain impressions and contact impressions are differentiated. Yet characteristic pain reactions can not always be regarded as evidence that the higher centers are involved, for the acephalous infant mentioned above, and a similar one examined by Flechsig, both reacted (very feebly) with cries when the skin was slapped or pinched. The facial expression of discomfort and the generally disturbed behavior is safer evidence that pain is really experienced than the mere cry. Even these are, after all, signs of disagreeable feeling in general, not of pain specifically.⁵⁶ Still, knowing how much more restricted are the paths of motor expression than those of sensory impression, and how invariable in later life is the rule that excitations of specialized nerve-ends never produce any but the special corresponding sensations, we may reasonably conclude that when a stimulus calculated to excite the nerves of pain is applied, and general signs of discomfort follow, the form of discomfort experienced is really pain.

The evidence of brain anatomy, so far as it is clear, confirms that of the infant's behavior. It is precisely in that region of the cerebral cortex to which sensations from the skin and the

⁵⁶ But see below, p. 44, and note 84.

body interior are assigned that Flechsig found medullation beginning earliest (at least two months before birth) and most advanced by time of birth; and he was satisfied, both on anatomical and clinical grounds, that several sensory conductions from the lower centers in medulla oblongata and spinal cord are functional up to the cortex a month before birth. It is impossible, of course, to determine anatomically whether these conductions include separate paths for contact, pain, and temperature excitations. But it may be inferred from the observations related above that they do; that the contact paths are earliest developed and most permeable; and that those of pain are barely functional at birth. This supposition brings the anatomical evidence wholly into accord with the observed facts; for no one has reported any reaction to pain stimulus in infants prematurely born, while contact stimulus is responded to by those born at eight months about as readily as by those born at full time.⁵⁷ It accords also with the old argument that touch must be the first special sense to develop, since it is the one that has opportunity of pre-natal exercise.⁵⁸ Phylogenetically, too, contact sense is very early in order of development; this is true of the sense of cold and heat also, but not of sense of pain.

Of any "local sign" in skin sensation I saw no indication whatever for many weeks. There was not even the most auto-

⁵⁷ Kussmaul, *op. cit.*, p. 33; Genzmer, *op. cit.*, p. 7.

⁵⁸ See the summary of early speculations on the senses of the newborn prefixed to Kussmaul's "*Untersuchung über das Seelenleben des Neugeborenen Menschen*"; also p. 5 of the same treatise. There seems no reason why the argument is not valid as regards contact sensations, though Kussmaul's views regarding prenatal exercise of taste must certainly be set aside (v. Tracy's *Psychology of Childhood*, p. 1, for a good summary of the whole question of prenatal sense experience).

The medullation of the optic nerve before light has ever reached the retina shows that early medullation is not ontogenetically due either to the exercise of function or to the impact of stimulus, however it may be phylogenetically; but the acceleration of its development in the visual paths of prematurely born infants, under stimulus of light (p. 23, note 18), shows that individual experience of stimulus does play a part in the rate of development of the sheath. We may therefore fairly enough credit the very early development of a functional condition in the paths between the skin surface and the cerebral cortex, in part at least, to exposure to contact stimuli before birth.

matic reflex tendency to turn the eyes or move the hand toward the spot affected.⁵⁹ And since at a later period this ability to localize might be seen in process of gradual development, it seems to me out of the question to suppose it existed already, in these earliest days.

The only recorded observation I have seen that suggests its existence at this time is one made by Kussmaul, and confirmed by Genzmer, viz., that hungry infants, only a few hours old, will turn the head at a touch on the cheek, and seize the touching finger with their lips. Genzmer considers this due simply to a diffusion of motor stimulus (from the joint effect of hunger and the finger touch), which sets the head turning; the finger is then accidentally touched and sucked. But if there is really a tendency to turn the head *toward* the touch-stimulus (under the condition of excessive reflex excitability caused by hunger), we may see here an analogy with the turning toward an auditory stimulus, seen by Genzmer (p. 31, n. 48), and the well-known turning toward visual stimulus (p. 26). In such a general tendency to *movement toward stimulus* there can be only a very old reflex activity, not any evidence of conscious localization.

IV. SENSIBILITY TO TASTE.

I made no tests of taste sensibility. But the dulness of the sense, even after the child was half a year old, made me believe that its condition at birth must have been most rudimentary.

The objective facts as to taste reactions in the first days of life, are well settled (with one exception, to which I will recur). The indifference with which children for weeks after birth swallow strong-flavored medicines has been noted over and over.⁶⁰ Never-

⁵⁹ "There was absolutely no evidence of the ability to locate such a sensation in a part of the body which he recognized. . . . The slow and laborious process was apparent by which the mental separation and differentiation of the bodily parts and surfaces were developed." Mrs. Moore, *Mental Development of a Child*, p. 77.

⁶⁰ Camomile tea (Sigismund), cod-liver oil (Champneys), soda mint (Mrs. Moore), aromatic spirits of ammonia, as I myself saw, were swallowed like so much water. Mrs. Cooley's boy, from the 2d to the 6th week, was treated before and after each feeding with a very bitter drug, for sore mouth: "Whenever he felt the swab at his lips he would cease crying.

theless, the systematic tests of Kussmaul and Genzmer establish the fact that decided reactions to gustatory stimuli can be called out soon after birth, and Preyer and Kroner endorse their results. These were, in brief: Sugar and *weak* quinine or vinegar solutions (usually from one fourth to one per cent.) excite sucking movements and behavior of comfort; stronger quinine and vinegar solutions, characteristic grimaces; still stronger, defensive reactions,—choking, opening the mouth, protruding the tongue, ejecting the fluid, and at last (at a strength of four or five per cent. quinine), restlessness and crying. Any adult finds even a one per cent. solution of quinine strongly bitter;⁶¹ with the infants it often required a two per cent. solution to produce a grimace; in one or two cases, quinine up to a strength of above five per cent. was sucked like sugar.

So far it would seem established that the responsiveness to taste stimulus is extremely slight. But there is one group of data (a somewhat doubtful one, to which I referred above in saying that the objective facts were well settled, with one exception) which seems to contradict this conclusion. It is a general belief that infants very early discriminate well between one milk and another, and reject a strange breast. Sigismund and Kroner mention the belief with acquiescence, but I know of no recorded observation that confirms it except Preyer's.⁶² His child, on the fourth day of life, refused cow's milk until it was sweetened, and Preyer believes he must have compared its sweetness with the mother's milk. It is possible that a finer taste sensibility exists as to milk than as to other forms of stimulus. Yet it is hard to think that infants who suck a two per cent. solution of quinine as if it were sugar, can distinguish between

and suck eagerly at the linen during the process of washing." (MS. record.) Tiedemann alone reports apparent repugnance to a medicine within the first five weeks; and he was very likely misled by the facial expression (pp. 39-40). Kroner asserts, however, that the infant will not take these alien fluids *as readily and perseveringly* as milk.

⁶¹ Quinine can be perceived by sensitive adults up to a dilution of one part in nearly a half million parts of water (Lloyd Morgan, *Animal Life and Intelligence*, p. 251).

⁶² *The Senses and the Will*, p. 124.

a little more or less sweetness in milk.⁶³ It is still harder to think that at four days old definite associations and the power of comparison and choice are established. We are in need of more numerous and precise reports as to the conditions under which one milk is accepted and another refused, or perhaps I should say, one stimulates sucking and swallowing, and another fails to do so.⁶⁴

That new born infants really experience taste sensations like ours, Kussmaul and Preyer are positive, impressed by the fact that sweet, bitter, and sour call out each the appropriate mimetic expression.⁶⁵ Genzmer thinks these mimetic reactions quite unconscious, and it is not till several weeks after birth that he finds evidence of true taste sensations,⁶⁶ viz., emotional reactions *without* the local ones (p. 19).

As a matter of fact, the so-called characteristic expressions of taste are far from being exclusively taste reactions. The "sweet" expression is merely the contented look that regularly accompanies the sucking movement, and is excited, together with the movement, not only by any moderate taste stimulus—sweet, sour, or bitter—but also by tactile and olfactory stimulus.⁶⁷ The "bitter" expression, with the choking reactions, is excited as well by touches at the root of the tongue, or by strong smells, as by taste stimuli;⁶⁷ it appears sometimes at any sudden taste, even of sugar,⁶⁸ or water (I, p. 160), and in older children and

⁶³ Mrs. Cooley's baby (see note 60, page 37), who was fed from the first on artificial foods, showed no preference among them, taking an unsweetened one as readily as one with sugar. My nephew at 10 weeks old, I note, did not seem to notice or care when the sugar chanced to be left out of his milk.

⁶⁴ It has been conjectured that the refusal to accept a strange breast was due to the unfamiliar *odor*. Genzmer and Kroner both assert that it is merely a matter of touch conditions, and that no objection is made to taking a strange breast if the nipple is easy to lay hold on, or a nipple cap is used. This explanation, however, does not cover the case of the discrimination reported by Preyer between sweetened and unsweetened cow's milk.

⁶⁵ Kussmaul, *op. cit.*, pp. 26–28; Preyer, *The Senses and the Will*, p. 119.

⁶⁶ *Op. cit.*, pp. 14, 15.

⁶⁷ Kussmaul, *op. cit.*, pp. 29, 30; Genzmer, *op. cit.*, pp. 5, 6; Garbini, *Evoluzione del Senso Olfattivo nella Infanzia* (Firenze, 1897), p. 15.

⁶⁸ Kussmaul, *op. cit.*, p. 25; Preyer, *The Senses and the Will*, p. 119; Kroner, *op. cit.*, p. 3; I, p. 160, of this series.

adults it expresses nausea rather than the sensation of bitterness.⁶⁹ So far, then, from being well-defined reactions to sweet and bitter taste, these expressions in early infancy seem to be general motor responses, the one to almost any moderate stimulus, tactile, gustatory, or olfactory, in the sensitive regions of mouth and nose, the other to various over-sudden or over-strong stimuli in the same regions.⁷⁰

That these reactions come from the primary taste center, without requiring cerebral participation, is certain, for they have been seen in an infant wholly destitute of cerebrum.⁷¹ Whether there is in normal children at birth any path practicable for the further transmission of taste impressions to the cortex is not known, nor is the cortical center of taste yet certainly located (Flechsig supposes it to be united either with the touch or the smell center⁷²), so the anatomical evidence is not available here.

Yet we may, on the whole, conclude that gustatory sensation of some sort exists. The general behavior of contentment that follows on sweet stimulus seems to follow at once, before sucking is fairly established, so that it can hardly be due wholly to pleasure in the motor and tactile sensations. Preyer thinks the behavior of displeasure upon strong bitter tastes unmistakable, and even if it does, as Genzmer thinks, lack the fullest evidence of being a true emotional expression, the probability is, after all, strong that it is such. There may be only a sub-cortical consciousness involved, and the feelings may be quite indefinite ones, of mere gustatory well-being and ill-being; or it may be that some of the impressions do make their way to the cerebral cortex, and are associated with sensations like our own in specific quality.

Taste, at least in the primitive form of a chemical sense able to distinguish proper food material, is of early origin phylogenetically. But throughout the whole mammalian period of human

⁶⁹ Kussmaul, *op. cit.*, pp. 28, 30; Genzmer, *op. cit.*, p. 14.

⁷⁰ The difference between the "bitter" and "sour" grimace Genzmer attributes (*op. cit.*, p. 15) to the astringent effect of acid on the gustatory bulbs, which slightly modifies the motor reaction.

⁷¹ Preyer, *Die Seele des Kindes* (3te Aufl., Leipzig, 1890), p. 93.

⁷² Ueber die Assoziationscentren, p. 53, note 2.

ancestry, discrimination and choice of food has been excluded during the first months of life, and this may have greatly delayed the sense in its ontogenetic development.

V. SENSIBILITY TO SMELL.

I saw absolutely no sign of sensibility to smell, but, rather, indications of its absence for months after birth (I, p. 174).

All observers agree as to the absence of any *spontaneous* signs of sensibility to smell in the first weeks. Yet artificial tests establish its existence from the first hours of life, as soon as the nasal passages are cleared of the amniotic fluid.⁷³ It has repeatedly been objected⁷⁴ that the odorous substances used by the experimenters had a certain irritating effect on the mucous membrane, and also that in applying them the element of touch stimulus was not wholly excluded, so that the reactions may have indicated tactile rather than olfactory sensibility; but after making all allowance for this, there is still plenty of evidence of reaction to olfactory stimulus.⁷⁵

These reactions correspond curiously in type to the taste reactions,—a mild stimulus calling out sucking movements; a

⁷³ Kussmaul, *op. cit.*, p. 34; Genzmer, *op. cit.*, p. 18; Kroner, *op. cit.*, p. 4; Garbini, *Evoluzione del Senso Olfattivo*, pp. 15, 16.

⁷⁴ Preyer, *The Senses and the Will*, p. 131; Garbini, *op. cit.*, pp. 5-7.

⁷⁵ Genzmer applied odorous liquids to the upper lip, a method that, no doubt, gave opportunity for stimulus from contact or wetness; but the reactions were not like those that follow contact or wetness, and were like those obtained by Kroner and Garbini, when they put the odorous substance on the nurse's breast.

So, too, as to the criticism that the reactions may proceed from irritation of the membrane by the vapors of strong volatile substances: when such substances as petroleum, amber oil, or asafoetida are used, the reactions are wholly unlike those which follow tactile irritation of the membrane. Garbini, who refuses to regard responses to any of these odors as truly olfactory, and names them "osmo-tactile," lays stress on his failure to obtain response when he used a different class of odors, such as that of decaying flesh. But in the absence of any power of active smelling it can not be expected that the infant will respond to any but strong, penetrating odors from volatile substances, which will pass spontaneously up the nostrils. Moreover, long after smell is unquestionably established, little children (in the second and third year) often fail to show the least repugnance to odors that seem to us offensive.

stronger one, grimaces; and the strongest, choking, opening the mouth and putting out the tongue, and at last, restlessness and crying. But signs of an affective element in the feeling experienced are plainer than in the case of taste reactions; so, at least, Kroner's report indicates decidedly.

Anatomically, we have plain evidence that smell impressions can reach a center of higher consciousness, since the olfactory paths are medullated to the cortex some weeks before birth.⁷⁶ It is perplexing that this sense, to all appearance the latest and the least developed of all in humankind, should be so early in functional condition, but there seems no doubt of the fact.

VI. SENSIBILITY TO MOTION, POSITION, AND MUSCULAR ACTIVITY.

This group of senses—"kinæsthetic and static"—has never been subjected to tests of any sort during the period of infancy. That the movements and positions of the body are felt from the first has been rather assumed than argued; but the assumption is altogether probable, since, unless these are felt, the formation of associations with them and the development of voluntary movement out of involuntary—processes that begin very early—would be impossible. There are sundry detached observations that support this belief. It is known in every nursery that babies are sensitive to jarring, and Champneys has recorded that immediately after birth his boy started when the scale of the balance in which he lay went down with a jerk.⁷⁷ Two babies, twins, reported in the same collection of papers, showed from the second day a remarkably sensitive feeling about changes of motion and equilibrium,⁷⁸ starting, gasping, and clutching with their hands as they were turned over, raised or lowered in bathing.⁷⁹ My niece seemed from the first to suffer discomfort if she lay long in one position,—a feeling made up of sensations of muscular and joint tension, pressure on the skin from the

⁷⁶ Flechsig, *Gehirn und Seele*, p. 53; Ueber die *Associationscentren*, p. 53.

⁷⁷ *Papers on Infant Development*, p. 42.

⁷⁸ *Papers on Infant Development*, p. 17.

⁷⁹ So also Mrs. Hall's child, and Mrs. Meade's (reported in a letter), for the first two months of life.

weight of the body, and organic ill-being due to impeded circulation. Experienced mothers and nurses make it a rule to change the position of little babies from time to time, and its effect in quieting restlessness is noticeable.

Anatomically, we have every reason to suppose that sensations of this class are experienced, even before birth, since in the eight-months foetus the posterior plate of the spinal cord and the mucous membrane of the ear-canals are not only fully connected with the cerebellum, but have medullated continuations to the cerebral cortex.⁸⁰ It may be conjectured, however, that the limited number of paths which are permeable to the cortex at this time, or even at the time of birth, does not include representatives from *all* the spinal nerves of sense. The movements of the infant in the first weeks tend to come under control progressively, from the head downward (I, p. 181); and as it is the rule of development that each motor nerve bundle begins to sheathe itself downward as soon as the corresponding sensory bundle has sheathed itself upward,⁸¹ we must suppose that the sensory consciousness of the body-parts had already arisen in the same order. It is, therefore, possible that in the newborn infant it has progressed only so far that he feels the movements of his eyes, lips, tongue, and neck, but not of trunk and limbs.

VII. ORGANIC SENSIBILITY.

It has not needed systematic tests to show that the newborn infant reacts to hunger, thirst, and organic pain, with every appearance of distress.

The part that *hunger* plays has doubtless been exaggerated by casual observation, and that of *thirst* underrated. It is some 48 hours after birth before the organic need of food sets in (I, p. 211; see also any modern text-book of nursing): yet during this time restlessness and crying appear periodically, and are appeased by water alone. Even after this, the craving for food must be quite as much thirst as hunger, and thirst alone is apparent at intervals besides (I, p. 234).

⁸⁰ Flechsig, *Gehirn und Seele*, p. 62, *et seq.*

⁸¹ Flechsig, *op. cit.*, p. 20.

Nor can the thirst-hunger craving be as strong as it seems, at any time in the first week; for its signs wholly cease if the infant can get anything convenient into its mouth and suck at it,—the pleasure of sucking apparently quite obliterating the organic discomfort. Genzmer, indeed, doubts whether there really is any sensation of discomfort, or whether the motor discharges are not due simply to the heightened reflex excitability that attends the physiological condition of hunger;⁸² when this excitability is discharged instead by the movement of sucking, the other reflexes (throwing the head and arms about, and crying) cease. But the whole expression and manner of the hungry child indicate discomfort; and we need not doubt that thirst and hunger are really felt, since it is known that by the time of birth there have been for weeks practicable paths for visceral impressions up to the cerebral cortex.⁸³ This accords, too, with the early appearance phylogenetically of some sort of hunger craving; and with the early appearance in the individual of associations in connection with hunger (I, p. 213).

Organic *pain*, unlike dermal, seems to be distinctly felt very early. Within a few days after birth, certainly, experienced nurses distinguish well between the cry of colic, that of hunger, and that of fatigue.⁸⁴

Of other organic sensations in the newborn, it may be said briefly that *nausea* seems entirely absent at this period, and for

⁸² *Op. cit.*, p. 18. In this reflex excitability, especially to touches about the lips or any stimulus adapted to call forth the sucking reflex (Genzmer, *op. cit.*, p. 17; cf. also Kussmaul, *op. cit.*, p. 80; Preyer, *The Senses and the Will*, pp. 152-153; Champneys, *Papers on Infant Development*, p. 41), there is a marked trace of remote phylogenetic origin.

⁸³ Flechsig traces the vagus and its continuations to its cortical radiation, in the 8-months fetus (*Gehirn und Seele*, p. 63).

⁸⁴ I, pp. 208, 211. Preyer thinks the cries distinguishable from the first (*The Senses and the Will*, pp. 152-153); Darwin could not distinguish them for weeks, though he was watching especially for emotional expression (*Papers on Infant Development*, p. 39). Champneys says that the child appeared to cry at first for three reasons, (1) loneliness or fright; (2) hunger; (3) pain; and that the cries seemed to be all different in character. But this distinction was probably not made in the very first days. *Papers on Infant Development*, p. 41.

months after.⁵⁵ Feeling of *suffocation*, it has been conjectured,⁵⁶ may be experienced on the interruption of the placental circulation, and may cause the first cry. Genzmer found that stopping the nostrils would bring infants to crying in about ten seconds.

VIII. GENERAL SENSATION.

One can hardly doubt, in watching a newborn baby, that he experiences vague shades of comfortable or uncomfortable feeling, which can be referred to no definite stimulus. Yet on the whole, the behavior of a healthy child, in these first days, is extremely passive and neutral in the intervals between definite sense experiences. There must be a multitude of faint impressions continually pouring inward from visceral and circulatory conditions, from muscle and joint tensions, from the contact of clothes with the skin, the pressure of the body on the bed, etc.; but whether the majority of these reach the threshold of consciousness at all is doubtful, the cerebral paths being so few, and most of them still so resistant. Whatever undifferentiated net result of feeling is experienced in consequence of them must be of the very faintest, and does not seem to be continuous. If there is any real continuum of feeling, underlying and connecting special experiences, it is probably sub-cortical.

Yet there is no room for the conjecture that the infant lies in an unconscious condition, broken from time to time by special experiences; for the special experiences practically fill all his waking hours. In particular, the lively sensibility of lips and tongue is stimulated by their perpetual touches upon one another; while their movements and those of the eyes are felt; and light is constantly reaching the retina, unless the room be wholly darkened. The larger part of the content of the baby's consciousness, then, in the first days, comes from sight, muscle, and touch experiences, and centers about mouth and eyes.

⁵⁵ I, p. 235. Cf. also Preyer, *The Senses and the Will*, p. 158. The same absence of nausea when food regurgitates is noticed in Mrs. Catterall's MS.; and is, indeed, a familiar observation in every nursery. It has anatomical reasons, in the position of the stomach, which allows the liquid contents to escape without muscular effort.

⁵⁶ Kussmaul, *op. cit.*, p. 44; Genzmer, *op. cit.*, p. 16.

IX. SUMMARY AND CONCLUSIONS.

It appears, then, that in normal infants at birth (or as soon as the conditions of extra-uterine life are established) the condition of the senses is as follows:—

1. *Sight* is only a dim⁸⁸ and wholly passive feeling of light and dark, without sense of distance or direction.

2. *Hearing* appears with more or less delay, and then only as a dull sensibility to auditory jar, rather than to sound.

3. *Dermal* feeling includes a sensibility to *contact*, lively about the face (especially lips and eyes), and duller over the rest of the body; a lively sensibility to decidedly *cold* touches, though scarcely to diffused cold; and an exceedingly dull sense of *pain*, roused with difficulty by intensive stimuli.

4. *Taste* and *smell* sensations seem wholly wanting under normal conditions, but can be excited by intensive artificial stimulus; it is doubtful whether the taste sensations even then pass much beyond a feeling of gustatory well and ill being. There are indications of imperfect central differentiation of taste from smell and touch.⁸⁹

5. Sensations of *motion*, of *muscular activity and fatigue*, of *equilibrium*, and visceral sensations, chiefly *hunger and thirst*, and *organic pain*, are felt quite distinctly, and make up altogether a considerable mass of feeling from the body interior; yet they are individually feeble at this period, and do not blend into any definite consciousness of the body. There may be some faint undercurrent of *general sensation*, in the intervals of special experience.

6. The content of consciousness in the newborn is chiefly made up of the sensation of light, and of touch and muscular sensations about the mouth and eyes.

⁸⁸ Retinal sensibility is keen, and the central paths well advanced in development, but the quantity of light admitted is so small that the sensation experienced must be faint.

⁸⁹ This is true even in adult life, to a less extent. It has often been noticed that we distinguish with difficulty between sensations of pure taste and those of smell (received through the rear nasal passages), as in the case of spices; and Groos points out that such sensations as the sparkling quality in wines, or the smoothness of creams, are in fact touch sensations (*Die Spiele der Menschen*, Jena, 1899, p. 14).

It will be observed that the sensations of the newborn are very limited and feeble, and seem to be simple and detached experiences; there is no sign of association between them, or modification of one by another. And this is confirmed in a striking manner by brain anatomy, which shows that the paths to the cortical centers are at this time very few, and some of them barely matured and probably difficult to traverse; while medullated association fibers are wholly wanting.⁹⁰

Again, there is nothing in the infant's behavior in the first days of life that indicates any memory or recognition of a sensation.⁹¹ Whatever trace may be left behind, at this period, by each single experience, it falls below the threshold of consciousness, and there must be a considerable accumulation of the traces, before they can introduce any representative element into sense experience.

These early experiences, then, unassociated with each other, unassociated with representations of their own former occurrence, are justly to be regarded as *pure sensations*, the simplest forms of consciousness we can conceive. In such experiences as these, there can be no consciousness of space, of externality or internality, of surrounding objects, or of self. Yet since each one has its *specific quality*, these accumulating experiences, once associated, discriminated, remembered, and compared, afford the material for highly-developed psychic life.

One more comment. There is nothing here that parallels any

⁹⁰ "Noch einen Monat nach der Geburt sind die geistigen Centren unreif, gänzlich bar des Nervenmarkes, während die Sinnescentren schon vorher—*ein jedes für sich, völlig unabhängig von den anderen*—herangereift sind."—Flehsig, *Gehirn und Seele*, p. 23. Elsewhere, however, the same authority adds, "Nur zwischen Reich- und Körperfühlsphäre verlaufen einzelne spärliche Bündel welche hinreichend entwickelt erscheinen um eine Erregung von der einen auf die andere Sphäre zu übertragen."—*Ueber die Associationscentren*, p. 57. We have here again the anomaly, noted on p. 42, of the remarkably early development anatomically of the olfactory center, while to observation smell seems the most belated of all senses, and the one least involved in associations during infancy. With this exception, Flehsig's report of the state of medullation in the cerebrum at birth corresponds remarkably to the results of observation on the state of sensibility.

⁹¹ If we except the incident related by Preyer, p. 38.

phylogenetic stage of sense development. Traces of the phylogenetic order are plain in the delayed appearance of cochlear hearing, the low development of dermal pain, the imperfect differentiation of taste from smell and touch; but they are traces only. Each sense of the newborn child has taken on its human type, in structure and function; the peripheral organs are complete, or nearly so, the centripetal paths are marked out, the centers differentiated; the efficient action of the sense apparatus as a whole is simply suspended, *for lack of central interconnections*. In the phylogenetic series, the effective co-operations of the sense apparatus, called constantly into function for the preservation of the organism, had to keep pace with the development of structure, and low-level interconnections were formed. In the human ontogenetic series the apparatus, protected by long intra-uterine life from any demand upon function while its structure is developing, has leisure to make ready a higher, cerebral type of co-operations, abandoning the lower (wholly or in great part) to the use of organic life. But these higher associative connections do not actually mature till extra-uterine life has begun, and the sense centers are individually in active function.²² Therefore there is a certain helplessness, and appearance of low sense development, in the young infant, which roughly counterfeits that of the low types of animal life; but without any real analogy. The mistake of those who try to find an analogy (v. Garbini, *op. cit.*) is that they fail to consider the high development of structure, the advanced differentiations, which have already taken place in intra-uterine life, while the parallel development of function was suspended. I need hardly add that it is out of the higher type of sense co-operations thus made possible that man's superior type of intellectual processes is developed.

²² The physiological process we may conjecture to be that the tension from repeated discharges in the sense centers leads to the medullation of the association paths going out from them, as well as to that of the voluntary motor paths (p. 36, note 58).

PART II. THE SYNTHESIS OF SENSE-EXPERIENCE.

We start out, then, with a content of consciousness made up of a limited number of pure sensations, unrelated, unrecognized, unlocated, but varying distinctly in intensity, in affective quality, and in specific quality, constituting nothing like a unified "stream of consciousness," yet practically incessant during waking hours, since stimulus of one sort or another is never lacking, —from the first a considerable mass of psychic material, awaiting only organization.¹

The process of organization I attempt to trace in the following chapters. It was in general the establishment of firm associations between sensations that regularly occurred together. Where movement was necessary to bring them together, an indispensable part of the process was the attainment of ability to repeat voluntarily the movement, at first automatic. Also indispensable was the development, at each step, of recognition of former experience.

The great lines of grouping and fusion, as they appear in my record, were as follows:—

1. A series of associations was formed between the visual and the muscular sensations that occurred together in the automatic movements of the eyes; and by means of these associations the power of voluntarily directing the eyes was attained, followed by the power of accommodation to distance, and then by the ability to trace outlines with the eyes,—to delimit surfaces,—that is, to perceive plane form; and, finally, by some purely visual-motor interpretations, viz., rudimentary perceptions of distance, direction, and of objects as such.

2. A like series of associations was formed, during the same period, between the tactile and the muscular sensations that occurred together in the automatic graspings and explorations of mouth and hand; and by means of these associations the power of

¹ For a more detailed attempt to realize the dim and fragmentary psychic life of the newborn, cf. *The Biography of a Baby*, pp. 55-57.

voluntarily laying hold upon objects and feeling them over was attained,—the power, that is, of grasping and of active touch, with, probably, some rudimentary tactile-motor impressions of distance and direction.

3. By a highly advanced process of re-combining associations, the whole visual-motor group of sensations experienced by the baby in seeing objects grasped by herself, was linked with the tactile-motor group of sensations experienced in the act of grasping; visually guided grasping, and then constant exploration of objects by sight, touch, and muscular sense together, became a habit; and by this means largely (aided by locomotion) the perception of solid form, the complete projection of objects in space, with the space-feeling itself, were slowly acquired.

4. Meanwhile, auditory sensations also became associated with the visual and muscular sensations experienced in connection with them, the source of sounds was sought by the eyes, and some auditory contribution was made to the perception of objects and of space. Another association series, between sounds as heard and the sensations of the vocal organs in producing them, brought about the ability to reproduce them at will, and thus made possible the later acquisition of speech.

The detailed account of the incidents which indicated the foregoing processes has already been published.² The following chapters offer a recapitulation and analysis of the most significant points.³

² Notes on the Development of a Child, under the several sense categories, and that of Grasping, Vol. I of this series.

³ I compare my results throughout with the records of others, viz.:—Tiedemann, Soldan's translation of Perez's version, Bardeen's School-room Classics, XIII, Syracuse, 1890.

Sigismund, *Kind und Welt*, Ufer's edition, Braunschweig, 1897.

Darwin, Champneys, and others, in Mrs. Talbot's collection of Papers on Infant Development, published by the American Social Science Association, 1882.

Preyer, *The Senses and the Will*, Appleton, New York, 1892.

Sully, *The Diary of a Father*, in *Studies of Childhood*, Appleton, New York, 1896.

Mrs. Hall, *First Five Hundred Days of a Child's Life*, *The Child-Study Monthly*, Vol. II (1896-1897).

Mrs. Moore, *Mental Development of a Child*, Macmillan, New York, 1896.

I. THE VISUAL-MOTOR ASSOCIATION SERIES.

1. STARING.

Arrest of the Gaze by High Light.—The earliest sign I saw of emergence from the "newborn" condition of sensibility above described was a fixed staring at light surfaces of moderate extent, such as a lighted tract of the ceiling, the nurse's glasses, etc. This appeared near the end of the first fortnight, and was conspicuous till the fifth week (I, p. 10).^{3a}

No other observer has recorded this long, fixed staring as a regular stage in development, though I find incidental mention of it in a number of records.⁴ Preyer, in setting down "staring" as the first stage in the acquirement of fixation,⁵ seems to refer only to the passive, wandering gaze of the newborn. The staring that I recorded was certainly an advance upon this; the eyes, it is true, were not yet directed at all, but when they encountered by chance an agreeable, mildly lighted surface, they had become able to hold to it. They were under some higher grade of control than before.

The nature of this control is suggested by Sully, when he says that the eyes may maintain their attitude "under stimulus of

Mrs. McLeish, Transactions of the Illinois Society for Child-Study, III, 2, University of Chicago, 1898.

MS. records of Mrs. Sharpe, Mrs. Beatty, Mrs. Chapman, Mrs. Wood, Mrs. Tilley, Mrs. Catterall, already cited in Vol. I; and of Mrs. Elsie Jones Cooley, A.B., Michigan University; Mrs. Alice Carter Cook, M.S., Cornell, Ph.D., Syracuse; Mrs. Florence Smith Hoyt, A.B., Smith College; Mrs. Martha Everett St. John, A.B., Smith College; Mrs. Laetitia Moon Conard, Mrs. Jessie Saunders, and Mrs. Daniels.

When I cite the above observers without mentioning any title of a volume, it is to the records above enumerated that I shall refer.

As these pages go through the press, I add such notes as can be hastily utilized from my own record of a nephew, now nine months old.

^{3a} My nephew at 3 weeks old would stop fretting instantly and his eyes would become fixed, upon encountering lighter tracts, or strong chiaroscuro.

⁴ *Op. cit.*, Preyer, p. 3; Darwin, p. 33; Champneys, p. 42; Alcott, p. 8; Sully, p. 401; Mrs. Hall, p. 458; Mrs. Tilley, Mrs. Cooley, Mrs. Conant, MSS. The staring is rarely distinguished clearly either from the passive reception of light that precedes it, or from the attentive looking that follows.

⁵ *Op. cit.*, pp. 41, 179.

the pleasure." The eye falls by chance on the lighted surface; the stronger and more pleasant sensation received increases the central metabolism; an intensified discharge passes down the motor paths at the moment in use, their permeability is increased, the wandering impulses drawn into them, and the eye is held to its place, sometimes for many minutes.⁶ And, in fact, I have recorded that with the beginning of this staring, the irregular spontaneous movements of head and eyes did decrease and gradually disappear.

Here is, as yet, no sign of any association formed, but rather of a physiological preparation for the forming of one. For with the inhibition of wandering impulses and the deepening of the motor channels by which the eyes are fixed, it must occur that sensations of clear vision and the corresponding sensations in the eye muscles are over and over, and for long periods, set up side by side in consciousness; at the same time, the paths are becoming very easy for the later conduction of voluntary impulses, to bring together the same double set of sensations by intentional looking.

It is evident, too, that some differentiation of the fovea has already begun (since it is on reaching the center of the retina that the bright image fixes the attention), and its further development is favored by the long staring. As to the significance of the stage in the general history of motor development, of will, and of attention, these aspects lie outside the scope of the present treatise, and can merely be mentioned here.^{6a}

Neck Movements in Aid of Seeing.—Close on this visual ad-

⁶ For an extended discussion of this highly primitive "hedonic" motor control, and the bearing of the "Spencer-Bain" theory on the case of the young infant, see Baldwin, *Mental Development in the Child and in the Race*, Chap. VII.

^{6a} Since writing the above, I find a full recognition of this stage, "staring," and of its significance in the development of attention, in a paper upon Curiosity and Interest, by G. Stanley Hall and Theodate L. Smith, *Pedagogical Seminary*, September, 1903. Drs. Hall and Smith, in answer to a questionnaire, received reports of 163 cases of infant staring, nearly one-half of which occurred under the age of three months; it is not reported, however, how many occurred under the age of one month—the period where we must look for it if we are to establish it as the first stage in the development of vision.

vance, in the third week, came signs of increased pleasure in organic and general sensation (I, p. 238). It is likely that tactile and muscular sensations were also involved in the pleasure. There seemed a development in pleasure-pain susceptibility all along the line. It was at this period, too, and at moments of highest comfort and exhilaration, and of visibly increased general innervation (I, p. 235) that movements of lifting the head began. Such a movement has been seen as early as the first day,⁷ and can not possibly be attributed to desire or volition, but only to an overflow of energy, seeking motor paths easy by inheritance. But it evidently associates itself not long after this period with the pleasure of better seeing, and passes (perhaps by way of a mechanical repetition of the movement, under stimulus of pleasure; see below, "Recurrence of Gaze") into voluntary effort. Even in its involuntary stages, it is important in inhibiting the irregular neck movements, and in preparing for the co-operation of neck and eyes in voluntary looking.

Preyer, however, saw a neck movement at this period (as early, indeed, as the second week), which aided seeing more directly, and which he sets down as "the second stage of fixation." The face was turned from one bright surface to another, within the field of vision, the look remaining a mere stare. Mrs. Tilley records the same thing, and Preyer cites an instance reported to him by Frau Strumpell,—both in the second week. I find no other record of it, nor did I see the movement. I hardly think we are justified in regarding it as a regular stage in the attainment of active seeing. It seems rather to be a development of the original reflex which rolls the face toward the lighted portion of the room (pp. 26-27); it differs from this only in being discharged by a less extensive stimulus. Preyer himself does not regard it as an intelligent or voluntary movement.

Recurrence of Gaze to Accustomed Spots.—My own record shows that there was, as early as the third week, a marked recurrence of the gaze to certain favorite spots, such as were to be seen habitually in the same direction, as the baby lay in a

⁷ Talbot papers, p. 20; MS. record of Mrs. Wood.

customary position (I, p. 10),—the mother's white forehead, *e. g.*⁸ Now this "recurrence" of the gaze may not be real,—the object, favorably located, may catch the eye by chance encounter each time; but I suspect close watching would show that the baby's gaze does not, in fact, roam about till by mere chance it strikes and adheres to its favorite brass knob, or gleaming spectacles, but rather reverts pretty directly to these familiar sources of pleasure.

If so, we have here an advance on the simple *maintenance* of the eye-position in staring; we have a *repetition* of the motor discharge, suggested, after a lapse of time, by the similar conditions, and probably, also, by a craving of the sensory cells for light stimulus.⁹ There is no memory, desire, or will in this, but rather the raw material of memory, desire, and will. As I conjecture the physiology of it, the spontaneous tension of growth in the motor cells connected with the eye-muscles, is reinforced by the tension of stored energy in the sensory cells, craving discharge by light-stimulus; and the previous experience of pleasure following a certain eye-movement has so far deepened the channels for that movement that the discharge is determined to these, and the movement is repeated.

For such a process as this, no associative connection is necessary between the centers of visual and of muscular sensation; a connection that, according to Flechsig's dissections, would be anatomically impossible as yet, since the association fibers are still wholly immature. It was only with the beginning of the fourth week, about the 22d day, that I began to detect evidence of any real association established in the baby's mind, and this was not in the visual field at all. She showed signs of recognizing the position in which she was placed for nursing. Even here there is no demand upon the activity of intercentral association paths; for all the sensations involved in the associated group,—organic, muscular, and tactile,—are mediated in

⁸ Mrs. Cooley records in the 5th week that a brass knob on the bedpost thus attracted her baby's gaze, but she does not say how early the habit began.

⁹ See p. 58 and note 15.

a single region of the cortex, Flechsig's Körperfühlsphäre.¹⁰ The association is therefore of primitive type; nor can I find in any record a single instance of any more advanced type at this stage, with the one exception of the incident of the 4th day given by Preyer, already commented on as doubtful (p. 38).

2. ACTIVE LOOKING.

Turning the Eyes to the Marginal Image.—At 24 days old, close after the first sign of association-forming, my niece turned her eyes, well co-ordinated, and even threw back her head, with looks of attention and interest, to bring objects from the margin of the visual field to the center (I, p. 14).

This advance passes beyond Preyer's "second stage of fixation," in which the face is turned from one bright surface in the field of vision to another, the eyes continuing merely to stare; it has some of the characteristics of his "third stage" (that of following a moving object with the eyes), to which it corresponds exactly in date. It was with the "third stage" that intelligent looking began in his observations.

This intelligent looking marks a great advance. It shows the fovea well established as the region of superior vision, and the "visual local sign" of the outer retinal regions already distinct enough to serve as a guide for the direction and distance through which the ball must be moved to bring the fovea to the desired spot. It also shows a fair co-operation in binocular movement. And evidently we have here under our eyes the process analytically inferred by Wundt: the series of visual sensations experienced as the image falls on the marginal portion of the retina, and thence travels across it to the center, has become so associated with the parallel series of motor sensations that at sight of the marginal image, the motor discharges necessary to produce these sensations take place. The difficult question is whether this association has been brought about by practice,—the first-fruit of individual education,—or whether

¹⁰ On the difficulty of forming dissimilar, as compared with similar, associations, see Wundt, *Human and Animal Psychology*, Lecture IX.

the movement (though voluntarily initiated) is adjusted to distance and direction by an inherited reflex mechanism.

One is disposed to the latter view, seeing how early and how suddenly the little baby is able to turn his eyes to the right spot. How could he possibly, in three weeks' experience (multitudinous though the roamings of his eyes have been) associate each point in the marginal field with its due visual local sign, and with the appropriate movement of the eyeball? On the other hand, it is difficult to suppose so much and so varied adaptability to differing conditions in an inherited human reflex; the adjustments are more like those of acquired automatic action, as in piano playing, than like those of our undoubted native reflexes.

In fact, the first human movements of looking are probably less skilful than we suppose. Wundt says that the infant *gropes* with his eyes for the object, and fixates it but imperfectly at first. I know of no observer who has recorded this groping, but all our records are wanting in precision at just this important point, and it is quite likely closer observation would prove him right.^{10a} Again, the only "objects" to which the eyes are turned at this stage are light tracts, usually several inches in extent, or else something swinging and moving about,—targets that it does not require nice aiming to hit well enough for practical purposes. And in the third place, it is by no means to be concluded that the baby's fovea has learned the road to every point in the marginal field of vision as soon as it has been seen to reach one, or several, with fair success. It is probable that for many days thereafter the instances of *new* achievements in directing the eyes are rare.

My own notes certainly indicate this strongly. For two or three weeks after the first instance of true looking, they continue to mention the long, fixed stare as the main visual activity (only more intelligent and interested in expression than before, sometimes even accompanied with signs of lively delight); they record over and over the recurrence of the gaze to favorite

^{10a} I could not detect "groping" in my nephew's case; but his early fixation was certainly very imperfect.

spots;¹¹ and for the rest, a constant *roaming about* of the eyes, in which disappearing traces of the primitive irregular movements were imperceptibly replaced by a sort of systematic *ranging* to and fro, which looked like a voluntary seeking for visual enjoyment (I, p. 14).¹¹

There does not seem too much difficulty, then, in interpreting the development of active looking as a gradual acquirement, learned by individual practice; instinctive only as all these race movements are,—that is, acquired by the individual along lines compelled by his inherited structure.¹² The process of learning, we may conclude, is but *begun* at the time the first successful looking is noted; and closer observations should trace for us its progress thereafter up to completeness, through a series of practice movements, guided by simple associations, and impelled by hedonic feeling.

That such simple associations were forming in several directions¹³ was now, at a month old, evident. This agrees well with Flechsig's report of the anatomical conditions at this date.¹⁴

¹¹ I have already cited Mrs. Cooley's record of this recurring gaze in the 5th week; and Mrs. Tilley and Mrs. Catterall both mention the ranging to and fro of the eyes at about the same date.

¹² Even in the case of such animals as inherit the most highly developed mechanisms of reaction to sense impressions, it seems to be the tendency of later observers to credit instinct with less perfection, and practice with more influence, than had formerly been done; compare Lloyd Morgan's and Dr. Mills's observations on chickens with Spalding's.

¹³ Chiefly the more intelligent and voluntary lifting of the head (I, p. 325).

¹⁴ Ueber die Associationscentren, Proceedings International Congress of Psychology, 1896, p. 59; Gehirn und Seele, p. 74. Elsewhere Flechsig says that at a month old he found *no* medullated association-fibers (Gehirn und Seele, pp. 23-24); but taking this in connection with the more detailed statement on p. 74, it is evident that he must mean "practically none." The first intelligent looking is reported by observers, as a rule, in the 4th week (Table VIII(b), p. 77), but there is no great discrepancy here, when one considers that the range of individual variation should easily cover a week; that I did not find the looking really established as a habit before the 2d month; and that the brains used by Flechsig, those of children dying at a month old, would be likely to show some retardation in developments belonging to the latter days of the first month.

Preyer, writing before Flechsig's investigation, and believing the cerebrum to be wholly undeveloped at the time following movements first take place, is constrained to say (in spite of the look of intelligence which he noticed) that no part is played in the progress by the cerebral cortex. From the great difficulty of this position we are now released.

And at just this period, when the infant is mastering the voluntary use of the eye, the formation of associations is in several ways especially favored:—

1. There seems to be from the first in the developing sense-cells not merely the capacity of receiving stimulus, but an actual craving for it,¹⁵ a tension and discomfort in its absence, which stimulates motor reaction. There is thus a movement, a ranging to and fro of the eye, which is steadily directed by the pleasure-feeling, at first automatically, and then by an easy development becomes voluntary movement, determined by associations with pleasant experience.

2. It may well be conjectured that the medullation of the cortex, which at this period is beginning to progress rapidly, takes place in group after group of cells and neurons in an order determined not solely by heredity, but also by pleasure-pain experience, and thus doubly tends to select and fix useful associations. That is: The interconnections necessary for the important race movements would in any case mature rapidly; but, moreover, adjacent groups of sensory cells in which at the same moment a pleasurable excitement is taking place, will exert a tension of excess energy on the undeveloped inter-connecting channels, and thereby hasten their medullation,¹⁶ while others will lag behind. The movement of the eye that fails to bring a bright image to the center of the retina excites no marked interest or attention; but the successful movement, by the cerebral excitement it produces, tends to bring promptly into a functionally matured and co-operating group all the cells and connecting paths involved in the experience. The useful association, in the process of forming, is thus isolated and, so to speak, anatomically protected from competition, and becomes early and invincibly fixed.

¹⁵ See p. 54 above. All my observation confirms Groos's views: "So besitzt, wie Jodl, in Uebereinstimmung mit Beaunis u. A., hervorhebt, jedes Sinnesgebiet nicht nur die passive Fähigkeit zur Aufnahme und Verarbeitung gewisser Reize, sondern es stellt sich auch zugleich schon ursprünglich als das Verlangen nach Erfüllung mit entsprechenden Reizen dar." *Die Spiele der Menschen*, p. 5. Many movements of the infant seem to be due to this craving.

¹⁶ See p. 48 and note.

3. In particular, the association between clear seeing and the movements necessary to fix the eyes is favored by the physical form of the eye, since the number of cases in which a chance movement will carry the image across the center must greatly exceed those in which it passes over any other one spot; and by the early staring, which arrests the image when it does reach the center, and emphasizes each successful movement by a long rest of the eye in the same position.

It is not strange, then, that a system of association between visual and muscular sensations, sufficient to direct the eye fairly well in right and left movements of fixation, should be organized so quickly as to seem to cursory observation a sudden unfolding of perfect inherited faculty.¹⁷

Following an Object in Motion.—On the 33d day I first saw the baby's eyes unmistakably follow a candle, slowly moved,—Preyer's "third stage of fixation." Had I tried the experiment before with a luminous object, instead of with the hand, I might, like Preyer, have seen this development earlier than active looking, instead of ten days later. It is really only one case of the same attainment,—that of the ability to turn the fovea upon an image already seen indirectly. The image moves off the fovea by a minute interval, and is at once overtaken by the turning of the eyeball; moves again and is again overtaken; and so on. Mrs. Cooley's MS. record says that her boy, in early following, moved his eyes "jerkily."

It is likely that there are more incipient stages in the ability to follow than we have knowledge of. In the case of my niece, every one else in the house pronounced her eye-movements "following" before I could record an unmistakable instance; and what I regarded as accidental coincidences between the movements of the object and of her eyes may really have been broken and imperfect attempts at following.^{17a} For some days before,

¹⁷ The first sign of color vision occurred simultaneously with the first active looking; but the whole subject of Color will be discussed by itself later.

^{17a} My nephew acquired the movement by slow stages, 24th–36th days; the successive slight overtakings were quite evident at first. He did not turn the eyes to the marginal image till the 39th day.

moreover,—from about the beginning of the fifth week,—she had had a habit which bore a curious appearance of deliberate practice for the very power under discussion: she would fix her eyes on her mother's face, and roll her head sideways, keeping the eyes fixed, thus holding the image on the fovea by turning the eyeball, quite as much as if it had been the image and not her head that moved. Mrs. Cooley relates a somewhat similar action at about the same date (fifth week): the baby was staring at a photograph which hung near his bassinet; the bassinet was moved slightly, but his eyes remained on the picture. Mrs. Tilley mentions such movements as habitual at five weeks; I saw a decided instance in my nephew in the sixth week.

Genzmer's experiments (p. 25) show that some ability to follow a moving object may be inherent in the reflex mechanism at birth. Such extremely early instances as those reported by Mrs. Moore¹⁸ must be classed with Genzmer's; and the lack of focus, which she expressly mentions, emphasizes the absence of any real fixation. It would seem that there is in the first week a reflex following, which fades out, and is replaced toward the end of the first month by a more perfect movement, of true sensori-motor type. Instances of the movement from the 5th to the 10th days, however, recorded by Mrs. Cooley and Mrs. Moore, are hard to place under either category.¹⁹

Nor is it easy to understand the remarkable irregularity in the date at which following appears, according to different records, as will appear from the table below (compare also that on

¹⁸ Comparative Observations on the Development of Movements, p. 1; Mental Development of a Child, p. 45.

¹⁹ "5th day.—He plainly tried to follow a lighted match with his eyes, but was successful for a few inches only. On the 8th day a white handkerchief was held before his face, then moved slowly to one side. He moved his eyes jerkily to keep it in range, but could not follow it more than a couple of inches on each side." Mrs. Cooley, MS. record.

"8th day.—He was seen to focus his eyes in looking at a hand. He looked fixedly at the hand when it was quiet, and followed it when moved. (Here unfortunately the notes have failed to record whether or not his eyes maintained their focus while following the hand, and the plane and direction in which the hand was moved.) . . . 10th day.—His eyes followed the hand of a person beside whom he was lying, five times in its course back and forth across some sewing." Mrs. Moore, *op. cit.*, p. 45.

p. 76). We need more continuous and detailed reports of the development of vision before we can determine the true place of this movement in its history.

TABLE IV. FOLLOWING A MOVING OBJECT WITH THE EYES.

STAGES OF THE MOVEMENT.	DATE.	OBSERVER.
Unfocused reflex following bright objects	2d day	Genzmer, Moore.
	3d day	Daniels.
	5th day	Cooley.
Light fixated and followed....	5th day	Moore.
	3 weeks	Talbot papers, Case A.
	4th week	Preyer, Sharp, Shinn (nephew).
	5th week	Shinn (niece).
	6th week	Talbot papers, Case D.
Object other than a light followed	8th day	Moore, Cooley.
	2 weeks	Daniels, Alcott.
	3d week	Tilley, Conard.
	3 weeks	Wood.
	4th week	Shinn (nephew).
	5th week	Catterall, McLeish, Hall.

Co-operation of Neck Muscles.—In both the preceding eye-movements,—turning the fovea upon an image at the margin of the retina, and following an image with the fovea,—I saw a good co-operation of the neck muscles with those of the eye; not a mere primitive rolling of the head toward stimulus, but a well-adapted movement to increase the range of the eye in seeking the image. In the first instance the head was thrown backward; in the second, turned far to the side. Preyer,²⁰ Mrs. Moore,²¹ Mrs. Sharp,²² Mrs. Conard²² and Mrs. Catterall²² mention movements of the neck in looking,—in two cases, at least, evidently the same new, well adapted movement that I observed.^{22a} Here we seem to see the neck muscles coming under cortical control almost simultaneously with those of the eye, and their motor centers drawn into the same association group with those of the eye. It is possible, however, that we have still only

²⁰ *Op. cit.*, p. 44.

²¹ *Comparative Observations on the Development of Movement*, p. 1; *Mental Development of a Child*, p. 46.

²² MS. records.

^{22a} My nephew made the movement, faintly and imperfectly, from the 4th week.

a reflex, acting upon a more delicate and complex stimulus than at first; still more likely that the movement is a transitional one, the former reflex act initiated by a hedonic impulse, but completing itself automatically,—adopted as a whole into the association group, so to speak. It is a simple movement, requiring no such adjustment to distance and direction as the eye-movement does.

Period of Practice in Active Looking.—Psychically a great advance is apparent with the beginning of looking, whether that date from “following” or from turning the eyes on the marginal image. The association groups now forming involve not merely a primitive recognition of former experience, as in the earliest type (p. 54), but a growing desire and volition. The important step has been taken of *bringing into one the testimony of two disparate senses by a voluntary movement*. The visual experiences have taken on the undoubted character of perceptions, though the content of the perception is nothing more as yet than an undefined light patch; and it is worth noting that with the very first active look, I noticed a marked increase in intelligence of expression, and that the same thing was noted by Preyer, and is in some way indicated in the notes of most observers at this period. In the weeks following, the voluntary exercise of the sense of sight, and the psychic development under its influence, show steady expansion. Both Preyer and Mrs. Moore mention the pursed lips, showing strain of attention in looking; and I saw the same thing, with marked tension about the brows.

The pleasure in the exercise of vision at this stage is reported over and over by all observers,—demonstrations of joy in glitter, in strong chiaroscuro, in moving and vibrating objects, and in the human face, with its changing high lights.²³ In all direc-

²³ *Op. cit.*, Preyer, pp. 45-46, also *Conspectus*, in *The Development of the Intellect*, pp. xii, xiii; Sully, pp. 402-403; Mrs. Hall, pp. 458-459 (January, 1897); Mrs. Moore, pp. 6, 45-47; Hall and Smith, pp. 320-321; Mrs. McLeish, p. 111; also MS. records of Mrs. Tilley, Mrs. Cooley, Mrs. Cook, Mrs. Beatty, Mrs. Daniels. Cf. also my *The Biography of a Baby*, pp. 78-92. Mrs. Tilley noted of both her children that they would stop crying to look at patches of light or other interesting sights; the same thing was true of my nephew.

tions the conscious life is enlarging at the same time: sensori-motor action appears in the limbs; rudiments of emotion appear, and expression of pleasure or discomfort becomes more vivid and various; new instances of "associative memory" are noted.²⁴ This is the period (covering almost exactly the second month, in the case of my niece), during which Flechsig found the association systems in the hemispheres taking on medullation in considerable number.²⁵

It is a period of practicing and perfecting the power of active looking. By its close, the baby was looking about freely from point to point within the field of vision, and following of her own accord the motion of objects at a proper distance; the eyes were fairly well focused for fixation right and left, up and down; and perceptions of *direction*, estimated in terms of two senses, were becoming systematized. But there could have been no perception of *depth* in space until the lenses could be adjusted to varying distances.

3. ACCOMMODATION.

Beginning of the Power.—It is not easy to fix the arrival of this important development. A reflex movement of accommodation, as we have seen (p. 28), can be forced very early, but does not involve the real visual adjustment of the lens to the distance of the object, for better seeing,—an adjustment probably reached only after many involuntary experiments in the converging and diverging of the eyes, accompanied by reflex alterations in the shape of the lenses. Out of the associations of these movements with the resulting visual appearance, comes the ability to adjust the eye for the distance of clearest seeing, exactly as happened in the case of learning the adjustment for direction. But the movements of the eye in accommodation are so minute and hard to observe that I know of but two or three

²⁴ The Biography of a Baby, Chap. V.

²⁵ Ueber die Associationscentren, Proceedings International Congress of Psychology, 1896, p. 59.

observers who have fixed the date of the development with any degree of certainty.²⁶

I believed that I saw the beginning of the power in my niece at eight weeks old, when she looked back and forth, from one face to another, at a different range of distance from her, with a marked interest and attention that showed both faces were fairly clear to her sight (I, p. 15). Certainly there was every indication that some important advance in vision took place at this time, for there was an immediate and noticeable increase in earnestness in looking about, followed by unprecedentedly long periods of sleep, as if from fatigue due to the crowd of new visual impressions.²⁷ There was also an immediate increase in the effort to hold up and balance head and body, and by the tenth week the baby sat habitually, propped with cushions, straightening up her back, holding her head erect, and turning it about to look this way and that,—a rapid advance in muscular control that bore every appearance of being stimulated mainly by the craving for visual enjoyment (I, pp. 325-327).

Reaction to Threat at Eye.—In the same week in which Professor Preyer observed signs of voluntary accommodation, he saw the first winking reaction when he thrust his head suddenly near the baby's eyes; I saw it on the same day in which I inferred the beginning of accommodation. All reports that I can find of its appearance place it somewhere near the same date.

²⁶ Preyer places the first voluntary accommodation in the 9th week (*op. cit.*, p. 54). Mrs. Tilley had good evidence of it at 7 weeks. Mrs. Saunders's boy in the 7th week followed persons with his eyes as they went into an adjoining room, but whether he kept the eyes well focused is not recorded. Sully speaks of "unpleasant squinting-like failures" in trying to converge the eyes on a near object, before the 6th week, and seems to regard accommodation as attained at 6 weeks (*op. cit.*, p. 402), but gives no observation in support of the opinion. Mrs. Moore reports accommodation "fairly good" in the 5th week; my nephew at the end of the 8th week followed movement toward and from his eyes, keeping the focus fairly well.

²⁷ I have said, I, p. 257, that sleep did not seem at any time to be affected by mental fatigue. In re-examining my notes for the later book, *The Biography of a Baby* (q. v. pp. 93-97), I first noticed how closely on the date of accommodation the increased visual effort followed, and upon this in turn the long sleep. Mrs. Tilley also notes remarkably long sleeping—twelve hours on a stretch—in the week or two following the appearance of accommodation.

TABLE V. DATE OF REACTION TO THREAT AT THE EYE.*

DATE.	OBSERVER.
Forty-first day	McLeish.
Forty-third day	Hall.
Seventh and eighth week.....	Soltmann (cited by Preyer).
Fifty-sixth day	Shinn (niece and nephew).
Fifty-seventh day	Preyer.
Before two months.....	Cook.

This reaction certainly does not indicate fear, but rather a faint shock from a sudden sensory impression; and there seems no reason why it should have been absent in the early weeks of life, and now appear, unless the child has become newly capable of some visual impression, not before received. If this new susceptibility be due to the power of following by accommodation the approach of a body toward the eyes, and perceiving with some distinctness its sudden expansion across the field of vision, the noticeable winking reflex gives us an easy means to fix the date of accommodation.

Growing Adjustment to Distance.—The adjustment to distance, like that to direction, is no doubt only beginning at the time it is first noted, and continues for a long time imperfect. At what date it is perfected, I know of no way of determining. Some indication is given by the slow increase of the distance at which objects were noticed. It was the twelfth week before my niece gave any attention to an object across a room (some 15 feet away, that is); and the fifteenth week before she did so habitually,—having learned, in the three weeks intervening, to follow the movement of people crossing the room, receding and

* Sigismund says that some children do not wink at an attacking finger even in the 16th week, and as Preyer points out (*op. cit.*, p. 27) this is clearly due to the small area occupied by the finger. The dates in the table are all based on a threat made with head or hand. I found that a thrust with the head produced the reflex earlier than one with the hand; Mrs. McLeish mentions the same thing, and it seems implied in Preyer's note. It requires, therefore, a progressively less stimulus to excite the reaction as the child grows older. Conversely, it is shown by Mrs. Hall's careful note, as well as by Preyer's, that upon a fixed stimulus the reaction becomes progressively stronger till it is complete—one day a slight tremor or the lids, next a more marked one, next actual winking. This gradual development can not be due to increasing permeability of the reflex arc, for even at birth this shows itself perfectly permeable to such stimulus as the retina is then capable of receiving; it must be due to some new and gradually acquired retinal susceptibility.

approaching. Up to the fifth month she rarely watched anything more than fifty feet outside the window. The distance at which she noticed and recognized increased steadily (for some time only as her eyes were *led on* by following large receding objects), and I saw no indication within the first year that she ever looked really far away, into the distance. In the latter half of the second year she certainly did not distinguish distant objects as clearly as the adults about her did (I, pp. 19-21). But in all this matter of distant seeing, other considerations come in besides that of the mere effectiveness of accommodation: viz., the growing vividness of visual images, and of clearness in retinal definition; and the development of attention, ability to interpret, and apperception.

Preyer, Sully, Mrs. Hall, Mrs. Moore, Mrs. McLeish, and Mrs. Wood have all noticed the increase in distance range of perception after the first three months. It is not easy to make any systematic comparison of the rate of increase, for all the notes except Mrs. Hall's are quite fragmentary, and in some cases the distance of perception, in others that of recognition, is recorded. The following summarizes fairly well all that I can find on this point:—

TABLE VI. INCREASE IN RANGE OF VISION.

DISTANCE OF PERCEPTION.	DATE.	OBSERVER.
Persons recognized or noticed across room, 10 to 15 feet...	12th week	Hall, Shinn (habitual by 15th week).
	3 months	Wood.
	14th week	Tilley.
	Late in 4th month.	Sully.
Objects 100 feet away attract attention ²	25 weeks	Shinn (niece and nephew).
	33d week	Hall.
	9th month	McLeish.
	51st week	Preyer.
Objects watched a block away..	27th week	Moore.
Moon noticed	6th month	Cook.
	At 12 months....	Shinn.

² In the 33d week Mrs. Hall's boy greeted his father with outstretched arms at a distance of 200 feet; while my niece up to the 85th week misnamed acquaintances at 100 feet—not, however, I thought, from defect of distant seeing, but from failure to fix on the proper traits for distant recognition (I, p. 21). In the 9th month Mrs. McLeish's daughter did not seem to recognize faces more than 75 feet away.

First Visual Idea.—In the incident of the 56th day that led me to suspect the presence of voluntary accommodation,—viz., looking from one face to another at unequal visual range,—there was involved another important advance, besides the mastery of the visual apparatus. The faces were so far apart in angular distance as not to be in the field of vision at the same time; in looking from one to the other it was necessary to turn the head and *look for* what was out of sight. A visual idea had therefore been formed. It is not to be supposed that at this stage the idea could have been held for many minutes; nor that it implied any such conception as that of the objective existence of the unseen face: the movement to bring this to sight no doubt followed an impulse arising from simple association. But with all the limitations, the incident revealed a growing representative element in the visual and motor associations, an enlarging psychic complex into which they were becoming knit.²⁰

Period of Practice in Accommodation.—During the whole of the third and fourth months the baby was constantly looking about, and exploring the visual field with diligence and eagerness; it remained her principal occupation till grasping was established.

Are we to suppose that during this period she saw objects in clear definition, or still only as unoutlined regions of light and shade? Recognition of a face was reached possibly by the 60th day, certainly by the 80th. The ninth week seems about the usual date. The following are the recorded dates I find for

²⁰ The parallel incidents that I find in other records are as follows:—

“39th day.—As the child lay looking at the wall, which was illuminated by lamplight, his father’s head was so interposed as to cut off his view. Thereupon he moved his eyes, and afterward his head, in order to see again the wall behind the obstacle.” Mrs. Moore, *Mental Development of a Child*, p. 46.

“11th week.—The child looked repeatedly, and as if comparing them, from the face of one person to that of another.” Same, p. 47.

“73rd day.—Lying on my knees looking at the fire, he turned his head clear around and looked up at me.” Mrs. Catterall, MS. record.

See also Sully, *op. cit.*, p. 405.

recognition of a familiar face,³¹ or evident discrimination between familiar and unfamiliar:—

TABLE VII. DATE OF RECOGNITION OF A FACE.

DATE.	OBSERVER.
Before eighth week.....	Sully.
Ninth week	Hall (58th day). Moore (60th day). Meade. Wood. Shinn (?). Tilley (eighth to tenth week?).
Tenth week	Daniels.
Eleventh week	Alcott.
Twelfth week	Shinn (if not ninth week).
Three months	Sharp. Wood.
Fourth month	Cook.
At four months.....	Hoyt.
With the second quarter year.....	Sigismund.

But the recognition of a familiar face does not prove that the outlines have been clearly distinguished. The grouped high lights in a face, which attract the baby's attention so early and so strongly, are characteristic enough in each one of a few familiar home faces to make recognition no difficult matter, without the help of any outlines,—especially when (as in the case of my niece's first unmistakable recognition) there are such marked features as long white beard, spectacles, and shining bald head; and as late as the seventeenth week I was doubtful how far the baby recognized any one except her grandfather.

There was, indeed, no indication at all, up to the thirteenth week, that anything except bright, moving, or lighted things,—

³¹ The first object recognized is almost invariably a face; next comes recognition of the breast, nursing bottle, spoon, cup, etc., about a fortnight later (Tiedemann, Sully, Mrs. Hall, Mrs. Moore, Mrs. Tilley, Mrs. Cook, Mrs. Catterall, Mrs. Crew).

steel buttonheads in a canopy over her, a dangling bunch of gay sachets, shadows flickering on the ceiling above the chandelier, the leaves of a note-book fluttered before her, silver napkin-rings rolled on the table, the bright, changing oval of the human face, had ever attracted my niece's attention. I will go so far as to say that, not only in my own record, but in the score of others I have examined, I have found no instance of interest in vision, up to about the end of the first quarter-year, which might not have been due to the illumination or the motion of the object, or to its being thrown into strong chiaroscuro.

The growing power of accommodation would add greatly to the pleasure of such sights, and especially of human faces, for it would enable the child to keep them in good range, as they moved from or toward her; but before surfaces could be distinctly delimited, so that the different plane forms of objects could interest and occupy the baby, and could become a means of discrimination and recognition, the art had to be acquired of running the eye about the outlines,—an art not so promptly picked up even by the adult when relieved of congenital blindness by an operation.³²

My own impression, after close comparison of all the indications in my notes, is that for about half of this two-month period (third and fourth months) of incessant visual exercises and absorbing visual interest, the baby was occupied mainly in the practice of accommodation, bringing patches of high light, bits of glitter, or moving and twinkling objects, from all about the room, to the range of best seeing, and learning to turn and look for them everywhere, and follow them as they approached and receded; but that shortly before the end of the third month (about the time, that is, that accommodation was fairly perfect within the range of a single familiar room, though still untrained for longer distances) the *forms* of objects began to attract attention.

4. PERCEPTIONS OF PLANE FORM.

The strong projection of a light surface against a dark, or of a dark one against a light, would almost inevitably sooner or

³² Preyer, *The Mind of the Child*, Appendix C.

later lead the eyes to follow along the edge of high light, and it is likely that here, as in other cases, the human face was the baby's first teacher, and also that a familiar outline was first traced repeatedly, before she began to seek new ones, looking from object to object.

At all events, it was in the twelfth week that I was struck by a peculiarly sober behavior as the child looked about. In other respects this week and the following weeks were a period of notable vigor and gayety with her, but in her visual exercises she showed new effort and mental tension. In the thirteenth week I saw her, for the first time, look attentively at an object that was neither lighted up, brightly colored, nor in motion,—a rattle, which she held in her hand. At fourteen weeks old she had a remarkable expression of *surprise* as she looked around with wide eyes; and this I noted increasingly for several weeks. The eyebrows were lifted, and the expression of eagerness and effort to comprehend was conspicuous; she would look about silently thus for many minutes at a time.³³ At this period persistent efforts were made to rise to the sitting position, apparently (in part at least) for the sake of better seeing (I, pp. 328-329).

In the seventeenth week, when held in the arms, she would exhaust one quarter of the room with this eager inspection, then turn her head and begin on another quarter. Carried to another side of the room, she would renew the eager inspection from the new point. Objects that had been in the room ever

³³ Mrs. Tilley records of her younger child, at the same stage of development (12 weeks, about three weeks after accommodation was well attained): "It seems as if he could not open his eyes wide enough to see all he would like to. He just looks, and looks, and looks all around moving his head from side to side like a little bird." I do not find mention of this period of serious visual investigation in other records; but there are fragmentary indications of it in the notes of Alcott (Talbot papers, p. 10), and of Mrs. Moore (p. 48), and also in Mrs. Tilley's MS. notes on her elder boy. It has been conspicuous in my nephew, in the 4th month. Looks of surprise in a new room are often noted. One exceedingly precocious child is reported as early as four weeks old to have been almost unmanageable in a new room, from visual excitements, and invariably to have had nervous tantrums afterwards (Mrs. Daniels).

since her birth were newly discovered, and regarded with attention,—a fan here, a picture there.

Since with every movement objects alter in their plane form as projected to our eyes, a baby—quite unable to infer the permanent solid form of each chair, table, or vase, and beginning to trace out plane form with his eyes—must live in a perfect kaleidoscope of shifting shapes. My niece's surprise, her eager tension, her apparent effort to bring things into some sort of mental order, the renewal of inspection, as if a new room had been entered, when I carried her to a new part of the room, and all this during the very weeks immediately following on the full mastery of the mechanism of vision,—these reactions seem to me to point to no interpretation except that she was during this period discovering the objects about her and becoming familiar with their different outline aspects.

When this familiarity was once attained, the eager study of the surroundings declined, to be renewed in new rooms. So, too, a face, seen daily all her life, but not intimately about her, was apparently discovered for the first time at four months old, with an expression of absolute amazement, jaw fallen and brows raised; and then daily watched with excitement and surprise, till it, too, became familiar.

5. EARLY VISUAL-MOTOR INTERPRETATIONS.

Direction and Position.—Not only the outlined form of objects, but also their directions and relative positions, must have changed to the baby's eyes with every change of her own position. I never saw any indication that this shifting of place was observed; the brain probably did not at this time take in any such perception as that of a *group* of things, whose individual members were distinguished, with their relations of distance and direction.³⁴ It is certain that I never noticed at this time (nor has any one else recorded) any instance of attention to the displacement of a piece of furniture,—a thing that often excites lively attention in an older baby.

³⁴ If we except that simple and most familiar group, the features of a well-known face. Mr. Alcott's baby at this stage of development was terrified at sight of a distorted face.

Undoubtedly, however, some feelings of direction were forming in connection with the passage to and fro of images across the retina, and especially when people whose movements the baby was following passed out of the field of vision, to right or left. Once, as early as the thirteenth week, she turned and searched about repeatedly for a person who had passed around behind her, showing that she had formed some idea of the general region in which the visual experience might be recovered; and in the fifteenth week, she was constantly following the movements of people to and fro. In the last days of the fourth month, sitting by a window, she showed great surprise to see a person disappear through a door and reappear to her sight outside through the window; and the surprise showed that she had formed some sort of expectation as to where and how people would appear and reappear, which could be jarred by a novel phenomenon. Of any ability to project a line of direction, to conceive direction beyond the immediate range of the eye, I saw no indication in the first four months.

Distance Estimate.—Of distance as measured by the reach of her own arm, or by the effort of locomotion to a place, the baby could at this stage have had no idea; but she was by no means without data for distance measurement. The feelings of passive movement when she was carried to and from objects, and the corresponding changes in feelings of accommodation in her own eyes, associated with the parallel changes in definition and in apparent size of the objects (now that she had acquired accommodation and the ability to see objects in good definition), certainly afforded material for beginning the long and slow process of estimating distances.

Probably she went no further in this process, within the first four months, than to notice the striking changes in apparent size caused by distance. How great these changes are one hardly realizes (accustomed as we are to correct them by experience) till he measures the comparative angle subtended in his own eye by an object at arm's length and one across the room. And consider how conspicuous they become when a light body is projected against a dark wall, or the converse; or when some

object of interest is gradually blotted out to the child's eye by the spreading image of an approaching body, or uncovered by the contracting outlines of a receding one. That my niece did, in fact, notice such changes, I thought indicated in the seventeenth week, by a special interest and curiosity with which she surveyed our faces across the room.

It is possible, too, that some association may have already gathered between the visual changes passed through by an approaching face and the immediately following experience of friendly attentions,—that is, that the baby could tell when a person was coming toward her; but I have only doubtful evidence of this. In any case, such inchoate associations as these are far enough from any real interpretation of distance.

Identity of Objects.—There is still a third inference for which visual-motor perceptions alone might supply material,—that of the identity of an object, seen in all its aspects, from its different sides. The face, the back, the side, the near and the remote aspects of a familiar person, seen over and over changing into each other as he recedes and advances and turns, and associated with his customary behavior, must in time come to be perceived by a baby as belonging together in an invariable group. So of familiar inanimate objects, as the baby is carried to and fro, or sees them moved about.

How far such grouped visual perceptions could ever fuse into a single perception of the object as one and the same thing, we can only guess, for, in fact, the process has scarcely begun before it is superseded by a far more efficient one: the separate development of visual-motor and tactile-motor perceptions is ending, the two types of perception begin to coalesce, and the world is hereafter studied with the threefold parallax of visual, muscular, and tactile sense.

So it was in the case of my niece at least: at four months old, when she was but just in a position to begin the process of identifying objects by the eye alone, she was on the verge of acquiring the power of grasping, which was to bring the whole mass of her tactile-motor perceptions to bear on them in co-operation with the visual-motor ones.

Nevertheless, the coalescence of the two types of perception proceeded slowly, and even after it had begun, I saw evidences that a process of unifying objects by the eye alone was in fact going on. In the nineteenth week the baby showed perplexity and amazement over the alternate presentation of the side and the front of a familiar face (I, p. 86); yet this transformation and similar ones had been seen a thousand times before, without surprise or attention. Unquestionably some effort to *comprehend* the phenomenon, to apperceive it newly, was now taking place. I must have had a single glimpse here of a process of identification (or of association-grouping that tended toward identification) which had been going on for some time already, and continued for some time afterward. A week later the baby showed a well-formed expectation of her grandfather's face at sight of the back of his head (I, p. 86).

This development belongs logically here, as the latest unaided visual-motor interpretation; but in date, as I have said above, it lies just beyond the period to which this section is limited, that of separate visual-motor and tactile-motor development.

6. SUMMARY AND TABLES.

The process of learning to see, then, as I traced it, was as follows:—

First: In the newborn condition, lasting some ten days, the baby received passive sensations of light, and the eyes were directed hither and yon without purposiveness by spontaneous motor impulses; reflex or spontaneous movements of accommodation also took place now, or at least before voluntary accommodation.

Second: From the 2d to the 5th week lighted surfaces, accidentally encountered, held the eyes by a very primitive and automatic action of the hedonic impulse.

Third: In the 3d week the eyes recurred to favorite spots, still under control of an automatic, but more developed, hedonic impulse.

Fourth: (a) At 24 days old, active looking began, by the movement of the eye to bring an object from the margin to the center of the field of vision.

(b) On the 33d day an object in motion was followed perfectly with the eyes,—a case coming under the preceding head; viz., active looking; and perhaps normally an earlier form of the development.

Fifth: A period of practice followed, lasting from about the 4th to the 8th week, during which active looking was perfected, and reflex or chance movements of accommodation were developing toward voluntary ones, under the selective guidance of the hedonic impulse.

Sixth: At 8 weeks old voluntary accommodation began, and became fairly perfect by the 15th week, for short distances (width of a room),—developed largely by following the movements of people as they approached or receded.

Seventh: From the 12th to the 17th week perceptions of plane form were rapidly developing, as the eye became able to trace outlines and delimit surfaces.

Eighth: From the 15th week on, associations were forming on which later perceptions of distance and direction rested, and a beginning was made of the recognition of objects as individual wholes, in all their different visual aspects,—perhaps only, so far, of a few familiar human heads.

Each stage of progress after active looking was attained was followed by a marked expansion of intelligence, and increase of interest and enjoyment.

Here we start out with (1) *passive sensations of light*, and (2) *automatic eye movements with their accompanying muscular sensations*; and see this raw material worked into a complex power of active vision, in a few months, by *the successive grouping together of associations under direction of the feeling of enjoyment*.³⁵

In the foregoing summary I have filled out the continuous line of progress, inferring transition (or practice) stages where they

³⁵ With an intimate co-operation at every step, of a developing memory image, and a developing voluntary motor control. Such an analysis as the foregoing brings into strong relief the impracticability of distributing a biographical record into strict categories of Feeling, Intellect, and Will, or other divisions of human faculty (p. 10).

were imperfectly observed. The following table gives a summary of the stages as specifically recorded, compared with those recorded by the three other observers whose records are consecutive enough to be used:—

TABLE VIII(a). DEVELOPMENT OF ACTIVE VISION.

Age of Infant.	Stages of Development, Observed by			
	Shinn.	Preyer.	Hall.	Moore.
1st week.	More sensibility to light, with spontaneous and reflex movements of eyes and neck.			2d day, Unfocused reflex following with the eyes. ²⁸ 7th day, Eyes turned from one bright surface to another.
2d week.	Fixed gazing begins. ²⁹	Turning face from one bright surface to another, in field of vision, with fixed gazing.	Fixed gazing begins.	8th day, Fixed gazing begins. 10th day, Following an object back and forth.
3d week.	Recurrence of gaze to favorite spots. ³⁰			
4th week.	Looking from one light surface to another. Beginning of intelligent looking ³¹ (at 24 days).	Following bright, moving object with eyes. Beginning of intelligent looking (23d day).	Looking from one object to another, back and forth. [Intelligent looking.] (28th day.)	Spontaneous following object in motion (28th day). Attention and interest roused by sights [intelligent looking].
5th week.	Following a bright, moving object with eyes (33d day).		Spontaneous following object in motion (32d day).	Looking from one light surface to another (30th day). Accommodation (31st day).
6th week.	Spontaneous following object in motion (40th day).			
7th week.		Spontaneous following objects in motion.	Winking at sudden approach to eyes.	
At 8 weeks.	Accommodation. Winking at sudden approach to eyes. ³²	Accommodation. Winking at sudden approach to eyes.		

²⁸Mrs. Daniels reports the same on the 3d day, Mrs. Cooley on the 5th day. For fuller comparison of various records on the subject of following, see Table IV, p. 61.

²⁹Darwin, Alcott, Mrs. Tilley, and Mrs. Cooley also report fixed gazing as beginning in the 2d week; Sully alone reports it in the 1st, and Champneys at "a week old."

³⁰5th week, Mrs. Cooley.

³¹Mrs. Tilley and Mrs. Beatty seem to date the beginning of intelligent looking in the 5th week; Sigismund 7th to 10th week in his own boy, 5th week in a little girl known to him. I date it 5th week in my nephew.

³²Mrs. McLeish, 6th week; Soltmann, 7th and 8th; Mrs. Cook, end of 2d month; Shinn, nephew, 8th week.

Sully places accommodation in the 6th week, Mrs. Saunders in the 7th. Mrs. Tilley at 7 weeks.

All the records agree as to the expansion of intelligence, the access of enjoyment in sight, and of expression in the countenance, that follows each step in development, after the first active looking.

It will be noticed that Preyer's record, Mrs. Hall's, and mine, are in pretty close agreement, both as to the order of development and its rapidity, but that Mrs. Moore's differs decidedly. It will be noticed, too, that the main discrepancies concern the date of following a moving object (p. 61). If we eliminate this discrepancy by considering intelligent following with the eyes the same development, essentially, as intelligent direction of the fovea to the marginal image, and drop out minor stages, we get the comparative table given below:—

TABLE VIII(b). TABLE VIII(a) CONDENSED.

Age of Infant.	Stages of Development, Observed by			
	Shinn.	Preyer.	Hall.	Moore.
1st week.	Mere sensibility to light, with spontaneous and reflex movements of eyes and neck.			2d day, Unfocused reflex following with the eyes. 7th day, Eyes turned from one bright surface to another.
2d week.	Fixed gazing or staring begins. Face turned from one bright surface to another.			Object followed back and forth [automatically].
3d week.	Recurrence of gaze to favorite spots.	Intelligent looking begins		
4th week.				Accommodation.
5th week.				
7th week.				
At 8 weeks	Winking at sudden approach to eye.			
400.	Accommodation.			

If I may be permitted to restate this table once more, in such fashion as to bring in the evidence of more fragmentary records, a still stronger agreement comes out as to the main stages of development and their order.

⁴⁰⁰ Shinn. last day of 8th week; Preyer, first day of 9th.

TABLE VIII(c). TABLE VIII(a) AND (b) RESTATED.

STAGE OF DEVELOPMENT.	DATE.	OBSERVER.
Fixed gazing	1st week	Sully.
	At 1 week	Champneys.
	2d week	Darwin, Preyer, Alcott, Shinn, Hall, Moore, Tilley, Cooley.
Directing the look (including "following"): Beginning of intelligent looking	4th week	Preyer, Shinn (niece), Hall, Moore.
	5th week	Sigismund (girl), Tilley, Beatty, Shinn (nephew).
	7th-10th week	Sigismund (boy).
Accommodation	5th week	Moore (†).
	6th week	Sully (†).
	7th week	Saunders, Hall (†).
	At 7 weeks	Tilley.
	8th week	Shinn (nephew).
	At 8 weeks	Preyer, Shinn (niece).

II. THE TACTILE-MOTOR ASSOCIATION SERIES.

This series of associations is not so easy to trace consecutively as the visual-motor one, since more organs are concerned,—mouth, hand, and arm, as well as the neck, which co-operates to a certain extent; and each one develops its own set of associations between tactile and muscular sensations in a somewhat overlapping order of time. The comparative data from other records, too, are more meager here.

1. GRASPING AND ACTIVE TOUCH WITH TONGUE AND LIPS.

Grasping.—In the fourth week I saw the first sign of any possible touch association. Up to this time sucking movements had taken place as a pure reflex, discharged by the touch of a suitable object in the mouth. Now they were suggested (when the child was hungry) by the external contact of a hand or cheek against her lips. At the same time, the lips were protruded and seized the skin that touched them.

This looks like a voluntary act, directed by an association already established between the warm, soft touch of the breast against the lips, the muscular sensations of the seizing and sucking movements, and the resulting satisfaction of hunger; and

there had been abundant opportunity for unconscious practice of the movements, as the nipple was placed in the mouth and withdrawn, or as the baby's own hands chanced to get in and out of her mouth. Yet it is not unlikely that the whole action was only an extension of the original sucking reflex. Preyer plainly implies that it is to be seen in the newborn period,⁴¹ and Mrs. Moore reports that her daughter, on the 4th day, could seize the nipple again when she had lost it from her mouth.⁴² Even as late as the fourth week, when I saw the movement, its manner was mechanical, quite unlike that of the active looking which began in the same week. It may perhaps be a movement analogous to that of the neck noted about the same time (p. 61), "the former reflex act initiated by a hedonic impulse, but completing itself automatically,—adopted as a whole into the association group, so to speak."⁴³

Active Touch.—In the seventh week the baby was often seen passing the tip of her tongue in and out between her pursed lips, with an appearance of attention and interest. Here was real active touch. A true association had been established between tactile and muscular sensations that had often been felt together and enjoyed, so that here again, as three weeks earlier in the visual field, we have *the testimony of two disparate senses brought together by a voluntary movement.*

The association was anatomically very simple, all the sensations belonging to the same cortical region (the "Körperfühlsphäre" of Flechsig); and it was the more easily formed because the touch sensations that entered into it were double

⁴¹ *Op. cit.*, p. 260.

⁴² *Comparative Observations of Movements*, p. 6.

⁴³ Movements of groping with head and mouth, as if seeking for the nipple, are often noticed in the hungry child during the early weeks. They have been seen quite perfectly developed on the 5th day after birth in a child born in the 7th month, and a "bottle baby" at that (MS. notes of Mrs. Chapman). Here we can have nothing but an automatic movement, due to the heightened reflex excitability of hunger. Later it seems to be utilized as a voluntary seeking, in aid of the mouth-grasp, but I know of no observation that traces the process of change.

From the end of the 8th week (56th day), my nephew began to make efforts to seize with the mouth (without visual guidance), at suggestion of touches about the lips.

ones, proceeding from both the touching surfaces, lips and tongue, which must have emphasized the experience in consciousness. The movement, too, was very simple, scarcely more than a repetition of one that had many times been made as part of the act of sucking, when the lips and tongue were protruded somewhat to seize. But I had no doubt, in observing it, that it was an intelligent act, performed for pleasure in the sensations experienced, not a mere mechanical repetition.

Whether it was preceded by such incipient stages of association as I traced in the visual series,—by a mechanical arrest of the movement of the tongue through pleasure in the touch of the lips, or by its mechanical recurrence to them after chance experiences of the touch pleasure,—I can not say. Probably it would be impossible for the closest observation to discriminate stages so precisely, amid the many vague movements of the tongue and lips. In any case, I failed to watch the mouth closely, not knowing that here, instead of in the hand, I must look for the earliest appearance of active touch and grasping.

It is noteworthy that the first distinct synthesis of sensations in the tactile-motor field occurred so much later than the corresponding one in the visual-motor field (the one in the seventh week, the other in the fourth). Considering that the tactile sensibility of the tongue, lips, and fingers is lively from birth, and that these organs are highly motile, continually responding to involuntary impulses, and encountering contacts on every side, it might be supposed that their tactile and muscular sensations would be early associated. That they are not, as compared with the light sensations and those of eye-movement, may be in part because the eye is even more motile than the tongue or hand, and light even more continuous than contact; in part because sensations of touch rouse less lively interest in a young infant than those of light. But I think it mainly due to the fact that the baby comes into the world with a complex touch reaction—that of sucking—already perfectly established on a lower level, requiring no suggestion through cortical associations; and this function not only meets all organic need, but also the hedonic demand, for it plainly gives pleasant sensations from the first.

A fortnight later, in the ninth week, the baby would put out her tongue and lick a cheek against which her lips were laid (I, p. 386); again (as the manner showed) a movement voluntarily initiated for pleasure in the sensation of active touch, but in itself a ready-organized inherited reaction, which has been seen as early as the first day of life.⁴⁴

I have scarcely been able to find in the records of other observers any note of these early developments of active touch.⁴⁵ I must think, however, that this is not because my niece was exceptional in the precedence of mouth over hand (a precedence eminently reasonable on phylogenetic grounds), but because other observers have been like myself occupied in watching for the first tactile development in the hand, and have neglected the mouth.

2. ACTIVE TOUCH AND GRASPING WITH THE HAND.

Active Touch.—Up to this period I had seen no sign whatever of attention to the hands, not even when they encountered each other, producing double sensations of touch; nor of any sort of control over their movements. Objects were still clasped without attention by the reflex movement of the newborn period. Now, in the ninth week, active touch began to appear; and in this case incipient stages of the association between tactile and muscular sensations were quite evident. Objects laid in the palm were clasped and held longer, and with some appearance of attention. The finger-tips were repeatedly held together when they chanced to come in contact, as though the sensations were enjoyed. Here we have two cases of the same thing that was observed as the first step toward formation of visual-motor associations,—the arrest of movement under influence of attention and pleasure, thus prolonging the pleasant sensation, and deepening the channels for later voluntary action (pp. 51-52).

⁴⁴ Preyer, *op. cit.*, p. 118.

⁴⁵ Mrs. Tilley's boy, in the 7th week, had a habit of licking his dress and his fists. By the end of the 10th week, I became satisfied that my nephew was entertaining himself by moving his tongue and lips over each other, and it was quite evident in the 11th.

In the twelfth week, true active touch in the fingers began,—and began exactly as it had in the tongue, by the attentive repetition of a familiar movement, originally reflex. The hands were clasped and unclasped, so as to brush the finger-tips across any surface on which they chanced to be resting,—a sort of contact that had over and over been felt as the hand closed automatically. The child's manner was attentive, and the movement seemed clearly voluntary. It was practiced for several days.

I find no mention in any other record of the arrest of movement upon contact of the finger-tips; but the prolonged and more attentive clasping is noted in several;⁴⁶ and also the first exercise of active touch with the finger-tips by fumbling movements over some surface (Table IX, p. 100).

Grasping.—Meanwhile another hand development was taking place,—the association between touch sensations and muscular sensations in hands and fingers, by which voluntary laying hold of objects became possible.

In the ninth week, as I have said just above, the primitive reflex clasping became longer and more attentive,—a development in the direction of grasping, as well as in that of active touch. Apparently the contact sensations of the whole anterior surface of the hand became thus associated with the sensations of clasping, and able to suggest the movement. In the tenth week the hand closed not only on a finger or pencil laid within it, but on folds of clothes that brushed across the palm or inner surface of the fingers anywhere. The manner of the action was highly mechanical, and the development seemed at first hardly

⁴⁶ Mrs. Tilley noted in the 6th week, together with the longer clasping, a closing and unclosing of the fingers. This might have been a mere automatic flexion and extension, such as is common earlier in the arm and leg muscles; or it might have been due to a sort of rhythmic failure and renewal in reflex responsiveness to the stimulus. But it was still a habit in the 9th week, when purely automatic movement in the hands was less to be expected; and it seems likely to have been a case of mechanical repetition of a movement under hedonic stimulus. My nephew in the 11th week, when his hands encountered by chance, would fumble the fingers against each other, roughly interlacing them; and thereafter active touch in the fingers developed rapidly.

to amount to more than an extension of the surface of reflex sensibility; it is probably like the first mouth grasping, a case of the discharge of an old reflex act, by association acquired through experience.

By the twelfth week objects were evidently "held on to" with attention and volition (I, p. 310). Before the end of the week (83d day) the clasping movement of the child's finger-tips to and fro on a tray before her had developed to a fumbling, or groping, across it, in the course of which the hand would soon encounter rattle or spools; and at the touch the article would be laid hold on and lifted,—most imperfectly, at first, but with increasing skill from day to day (I, p. 210). Even when the back of the hand was touched, grasping was suggested.

Here was plainly voluntary grasping,—intelligent action, tested by the ability to learn skill by trial and error; but grasping without any visual help, stimulated by tactile-motor ideas and directed by tactile-motor sensations. Here is also a real *seeking* for contact sensations, by repetition of movements that have previously given them (exactly as in the ranging to and fro of the eyes for light sensations just after the acquirement of active looking, p. 57); whether stimulated by mere touch-hunger in the fingers, or by an idea of the sensations to be obtained, I can not say; probably at first by the one and later by the other, for I noted a gradual increase in consciousness and intention in the manner of the action.

This tactile-motor period of grasping was distinct and prolonged in my niece's case,—perhaps because she was supplied with conveniently placed objects for grasping, a month before visually guided grasping appeared. Most records, however, have some mention of such a period.⁴⁷ Preyer mentions a

⁴⁷ *Op. cit.*, Preyer, pp. 245-246; Sully, p. 413; Mrs. Moore, pp. 15, 16; Mrs. Hall, p. 396; Mrs. McLeish, p. 118; MSS. of Mrs. Beatty and Mrs. Tilley.

The notes of Mrs. Hall, Mrs. Moore, and Mrs. Tilley, in recording this period, all mention first the habit of longer and more attentive holding, when objects have been clasped by the primitive reflex, and later the grasping upon contact (Preyer, however, in the reverse order); there is also, especially in Mrs. Tilley's notes, evidence that this grasping was at

grasping at twelve weeks old, which "looked just as if the child had purposely seized the finger," and sets it down as a reflex act, apparently only because he has not taken into consideration the possibility of any intentional grasping that is not visually directed. Sully relates an incident that showed his child able in the eleventh week to reach out and grasp an object *felt*, though he could not reach for one *seen* till he was nearly five months old. Mrs. Moore's child seems to have had a habit of ranging through the air with his hands for chance contacts and opportunity to seize, some weeks before he was capable of visually guided grasping. And so simple is the chain of association by which a child can feel for and grasp an object, compared to that by which he looks at and grasps one, that I can not avoid thinking the stage a normal one.

During the same period in which this tactile-motor grasping was developed (9th-12th week), another development had been taking place,—that of ability to direct the hands to the mouth first so mechanical in manner as to be scarcely distinguishable from reflex movement, and increased steadily in intelligence and intention. This corresponds with my own observation.

A period of tactile-motor grasping was clearly evident in my nephew; I give a condensed account of its development:

11th week: Claspings down no longer follows as an invariable reflex when a finger is laid in the palm, but seems to require some attention to the feeling.

12th week: Claspings takes place or not, with every appearance of volition. It seems to be suggested by the touch of the finger-tips against any surface, as well as by touches in the palm. Holding is longer and more attentive.

13th week: Touches on finger-tips plainly suggest claspings, and folds of drapery are sometimes taken hold of in this way; the child seems to have a certain intention of getting hold. The hand feels well innervated, not merely automatically responsive. Still, the manner of all hand action is still mechanical, and but slightly attentive, far inferior to visual activity.

14th week: Habitually lays hold of articles on chance contact, but only when anterior surface of hand is touched, and the object conveniently situated, so that a simple claspings movement will answer; thumb not reversed.

15th week: Increased disposition to grasp; lays hold of his blanket, dress, etc., and drags them up about his head; hands are constantly moved, as if desiring occupation, and whatever comes well into their range is laid hold of and fingered. The thumb still not reversed. (At this stage, visually guided grasping began to appear, and the tactile-motor type did not develop further. The thumb was often well reversed by the 19th week.)

at will; so that by the time the new hand-power was acquired, it could be brought into a great association group under the powerful suggestion of mouth pleasure. This parallel development, and the succeeding ones, by which hand, arm, and mouth were all brought into co-operation, I review in the next section.

3. ASSOCIATION OF MOUTH, ARM, HAND, AND NECK SENSATIONS.

Carrying the Hand to the Mouth.—Up to the ninth week the arm movements, like those of the hand, had remained, so far as I could see, wholly automatic (with the single exception related in Note 51, p. 86), differing from those of the new-born period only in their greater amplitude, and in the ease with which they were stimulated by every wave of excess energy.⁴⁸ In the usual involuntary tendency⁴⁹ of the arms to move upward, however, was given occasion daily and hourly for pleasurable sensations about the mouth, as the fingers found their way into it and were sucked, or as they passed over the delicate tactile surface of the lips, and for associating these with the sensations of lifting the arm, which invariably preceded them.

With the ninth week I began to see evidence that this association was forming, in imperfect but unmistakably purposive efforts of the hand to reach the mouth. Whether it was preceded by incipient stages, my notes do not enable me to say. I had some impression that at an early stage the hands were checked in their random movements when once they had been seized in the mouth, and sucking had begun,⁵⁰—a case of in-

⁴⁸ This gave them, it is true, a certain definiteness of character as expressions of feeling, unlike the meaningless flexions and extensions of the newborn period.

⁴⁹ Preyer, *op. cit.*, p. 242.

⁵⁰ The evidence of recorded observations may seem rather against this. Mrs. Moore records that as late as the 10th week, when her boy was plainly trying to put his thumb in his mouth, "spontaneous movements often jerked it away—the child would cry with vexation but persevere"; and Mrs. Tilley reports of her boy at 7 weeks old, "Seems sometimes as if he were much disgusted at letting his fists go from his mouth, but does not seem to know how to keep them there." Yet both these notes imply that there was some tendency to hold the hand still, often overcome by stronger stimuli to movement, or by mere force of gravitation. And, indeed, it is often observed that children, up to a considerably later period than this, find it hard to keep the hand at the mouth, in defiance of counter-stimuli and of gravitation.

voluntary maintenance of a position under influence of pleasure; and it is probable that the earliest purposive movements of hands toward mouth that I saw were of the nature of mechanical recurrences,⁵¹ in which the motor impulse was given by the touch-hunger of the mouth (as the eye-movements were stimulated by light-hunger), and determined along paths made easy by former experience of pleasure, as well as by inheritance. The whole behavior of the infant in the early months shows that the mouth does crave touch and muscular sensation, as the eye craves light; the highly charged cells of its sensory centers are in a continual state of tension, which demands discharge by the appropriate stimulus (p. 58, and note). Nor is this surprising, when we recall the phylogenetic antiquity and

⁵¹ I find several traits of mechanical recurrence in the movement. The strong tendency to bilateral symmetry in it is one. Mrs. McLeish found that in the early stage of getting the thumb to the mouth, a week before it was done "with evident intention," there was a symmetrical movement of both hands upward, ending in sucking the right thumb. "When on the 63d day, I held the left hand, she could not get the right hand into her mouth; tried many times, and at last cried" (*op. cit.*, p. 117). Mrs. Hall noticed much the same thing, even after carrying the right hand to the mouth was fairly acquired (*op. cit.*, p. 395).

I recorded, in the 7th week, one incipient stage (an abortive one) which was of somewhat different type. A pencil placed in the hand was carried persistently back to the mouth, as often as it was pushed away (I, p. 306). As I saw the ability to carry things to the mouth acquired by a visible process of trial and error, some weeks later, I could not regard this precocious act as voluntary; nor was it properly a case of the mechanical recurrence of the muscles to a habitual act. It seems rather that we have here the process of true association-making laid bare at an early stage: an incipient association was actually made, but held only long enough for half a dozen closely following repetitions of the movement.

A somewhat similar case of transitory ability to repeat a movement is given by Mrs. Moore: when her boy, in the 7th week, was sucking his thumb and the hand was removed from his mouth, if it found its way back within twenty minutes it was presented in the same way as before, so that the thumb could be seized by the mouth; but not if longer time had passed. So also from the 11th week, my nephew's hand would return directly to his mouth as often as removed, if it was released at once; but if held for half a minute, it could not.

Mrs. Moore mentions also a precocious instance of carrying an object to the mouth as early as the 5th week, which (as in the case observed by me) seems to have led to the establishment of no association.

importance of a delicate touch and motor sensibility about the entrance to the alimentary canal.

There followed a period of practice movements, in which the process of trial and error was clearly apparent, and the sensations of the successful arm movement were daily better associated with the mouth sensations, till in about a week the baby could direct her hands quite accurately, at will, to her mouth, and did it constantly. Very quickly, too, the movements of the wrist that presented the thumb were drawn into the association group, and by the twelfth week the hand was intelligently turned to put the thumb into the mouth.⁵²

First Tactile-Motor Ideas.—In this arm and mouth association the sensations linked together by practice are not simultaneous, as in the case of directing the eye, but successive: the feeling of the hand in the mouth can not be had until after the arm movement has been performed. Something of a tactile *idea*, then (or, rather, a tactile-motor one, since the complex of tactile and muscular sensations experienced in sucking forms its content) is required as a part of the association.

The action stands, therefore, on a higher psychological level than that of merely directing the eye to an object in the marginal field of vision, and corresponds to that of looking for an object out of sight. The same thing is true of the groping for objects with the hand, noted in the same week (twelfth), if this groping had in fact as yet passed beyond the stage of a mere recurrence movement, under stimulus of touch-hunger alone.

⁵² The notes of Mrs. Moore and Mrs. McLeish imply a different order of development here. Instead of raising the hand to the mouth, to be laid hold of and sucked just as it chanced to present itself, and later learning to turn it and present the thumb, the infant first learned, on feeling the hand touch the face by chance movement, to direct it to the mouth, and even to turn it and present the thumb, before the upward arm movement was under control at all. This seems in some respects the easier order of development—the hand first touching the face and moving across it, often reaching the mouth by chance; then guided across the face in the right direction. In this case, we should have continuous parallel series of sensations, tactile and muscular, to guide the movement, and a continuous sensory stimulus, exactly as in the case of the transit of the visual image across the retina. It was thus, in part, in my nephew's case (see note 56, p. 90).

It illustrates strikingly the precedence taken by vision over touch that after first mastering the adjustments of a more complex muscular apparatus, the visual activities are still nearly a month in advance of the tactile in taking on the ideo-motor type.⁵⁵

Carrying Objects to the Mouth.—By the thirteenth week the ability to take an object into the hand, and the ability to direct the hand to the mouth, had become separately complete; but it required a still further development of the association group before an object could be voluntarily taken and carried to the mouth.

When the hand, after closing on an object, chanced to be lifted, it is evident that new sensations were at once experienced, besides those of contact in the hand and the ordinary sensations of motion in the arm: feelings of weight altered the whole muscular sensation of arm, wrist, and hand. When the hand chanced to be carried to the mouth, the object it held was touched by the lips and tongue, mumbled, licked, and sucked, giving rise to a variety of sensations that evidently attracted the baby's attention. By the thirteenth week, the feel of something in the hand had evidently come to be associated with these sensations, and to suggest the movements that afforded them: for objects when laid hold of were brandished with evident intention, and imperfect efforts were made to carry them to the mouth, improving day by day.

That the movement of hand to mouth, already well learned, had to be to a certain extent relearned when the arm-sensations were altered by the weight of an object, is strong evidence that the development is not purely instinctive, but requires individual experience. And the process of learning, associating the feeling of the successful movement, in trial after trial, with the desired sensation, was here remarkably clear. As the objects held in the baby's hand were not inspected visually, nor felt over, there could have been no conception of their extension out-

⁵⁵ It was probably because of the inability to form a tactile-motor idea that the precocious ability to lift the hand to the mouth in the 7th week (p. 86, note 51) failed.

side the hand to guide in turning them and directing them into the mouth; they could only be lifted again and again, striking the nose or cheek, lying across the mouth, until the right combination of movement in arm, wrist, and fingers was struck, and its feeling fixed in the association group (I, pp. 310-311).

The whole fourth month,—from the thirteenth week to the seventeenth,—may be assigned to this practice period, but it ran on several weeks beyond, into the period of visually guided grasping.

Almost all observers make some mention of a habit of carrying objects to the mouth at about this period; but I am not able to determine from their records the date of the beginning of the practice, nor its influence in the acquirement of true visually guided grasping (see pp. 99-100 and I, pp. 403-405).

Grasping with the Mouth by Neck Movements.—Meanwhile, as soon as the ability to lift the thumb toward the mouth had been fairly acquired, in the twelfth week, I had noticed a well-adapted downward movement of the head to aid the mouth in grasping it; so that in fact the thumb was quite as much seized by the mouth, by a neck movement, as it was raised and put into the mouth by an arm movement. After the baby had learned to put objects into her mouth, from the thirteenth week on to the twentieth, even after visually guided grasping had begun, mouth-grasping, with excellent co-operation of hand, mouth, and neck, continued conspicuous (I, pp. 309-317, *passim*; pp. 399-401, Tables III and IV; p. 404).

Probably this co-ordination was acquired by more gradual steps than I observed,⁵⁴—perhaps through movements of the head at the breast; but it certainly suggests a great phylogenetic antiquity,⁵⁵ and may have developed so rapidly, along the lines of association deeply marked by inheritance, as to have seemed an almost perfectly transmitted instinct. Certainly there is

⁵⁴ Mrs. McLeish notes that as soon as her little girl had learned to direct the thumb to the mouth, the mouth was opened as soon as the thumb started upward. See also the observations on my nephew, note 56.

⁵⁵ Kipling somewhere mentions it as a well-known habit of infant monkeys to reach for objects with the mouth, before learning to use the hands.

no such visible process of learning by trial and error as there is in the case of carrying the hand to the mouth, and in that of carrying objects to the mouth with the hand,—both, of course, movements later in race history than seizing with the mouth by neck movements.

I have already called attention, in the pages cited just above, to the frequent mention of the mouth-grasp by other observers. I can not, however, determine from their records whether they saw it before the period of visually guided grasping: Tiedemann's note seems to imply that he did.⁵⁶

⁵⁶ *Op. cit.*, p. 21.

The organization of this co-operation between hand, arm, mouth, and neck in my nephew's case shows strikingly the gradual nature of the process. I give a condensed transcript of my record:

9th week: At the touch of nipple or his own hands, about the lips, the tongue is thrust forward, and the mouth twisted and stretched toward the object, but no real ability to seize with the mouth, only to lay hold when the object is fairly between the lips; 61st day, the head also is turned in such efforts.

On the 62d day, the head is moved toward the hands when they approach near the mouth, the mouth meanwhile opened expectantly; this without visual aid, evidently by association with the muscular feeling in the approach of the hands.

Automatic tendency of arms to flex upward is peculiarly strong in the boy, and hands are thus brought to mouth without effort to direct; throughout 10th week no advance in directing.

11th week: Hands are moved about with appearance of effort and desire, but no intelligent direction toward the mouth, till they chance to come into immediate mouth neighborhood (perhaps an inch or two distance); then they are slowly guided in, especially if the lips are touched. I suspect the appearance of effort and desire is due only to vague touch-hunger of the mouth, not definite idea.

12th week: Arms flexed more consistently upward in trying to reach mouth; when they come near it, more intelligently steered, while the head is dived forward to meet them.

15th week: Has begun to grasp objects upon contact, and pulls his blanket, etc., up with both hands before his face,—merely for pleasure in the action, it appears; no effort to put in his mouth.

16th week: When he lays hold of folds of drapery, our fingers, etc., he drags them about with undirected movements, but appearance of desire, especially up and down, with the habitual flexing of the arm, till they come within 3 or 4 inches of the mouth, then tries to carry them to it, or to reach them with the head,—once lifting shoulders in the effort, as he lay, to get the head far enough forward.

17th week: Gets his rattle to his mouth by a very primitive trial and error method, lifting and lowering it each time, till it chanced to hit the right place. But visual guidance is now beginning, and purely tactile-motor associations checked in development.

4. PERCEPTIONS OF SURFACE.

It requires an effort to divest our own tactile-motor perceptions of visual representation far enough to get any glimpse of what the baby's must be at this stage. But in my niece's case it is certain that up to the middle of the fourth month they were not affected by sight. She never noticed her own hands as they moved about; never turned her eyes toward them nor toward any other part of her body upon feeling contact there, even when evidently interested in the experience; never looked at objects while touching or holding them (I, p. 312). And all records that I know are in practical agreement with mine as to this.⁵⁷ Even when the objects that she touched were the same ones that she had often seen, she seemed to feel no relation whatever between the visual and the tactile experience: she had, so to speak, no idea that what she touched was the same thing as what she saw.

Again, her tactile-motor perceptions themselves must have been almost wholly devoid of form-representations. For she had never felt over and about any object, acquainting herself with its extension,—and here too all records that I know are in practical agreement.⁵⁸ When she laid hold of anything, therefore, she could have had no idea—visual, tactile, or muscular—of its existence beyond the surface of immediate contact with it; no visual or tactile idea of her own hand, outside its areas of contact with the object and with itself; nor of the arm that raised it to her mouth. Only within the mouth-region, where the constant movements of the tongue must have made the inner surface of the mouth fairly familiar, and where one or two objects (the mother's nipple, at least, and the baby's own thumb) had

⁵⁷ A number of observers report interest in looking at the hands earlier than I do; but in every case it was plainly either such interest as might be shown in any visual experience (as if the hand had been some one else's, waved before the baby's eyes); or else it was an early stage in the fusion of visual and tactile perceptions, which in my niece's case began somewhat differently.

⁵⁸ The automatic movements of the hands about the face, always seen in vigorous new-born children, are sometimes mistaken by the observer for intentional explorations. But real hand investigation of objects before the epoch of visually guided grasping has never been recorded.

been daily grasped, held, sucked, drawn in and out, and felt over with the tongue, could any ideas of form have been obtained. I am not disposed to think that they were obtained, even here, for there had been no *attentive* investigation of the objects; the data may have been present for a perception of form, but it is not likely that they had been utilized.

Of surface, however, the baby must undoubtedly have had perceptions, when she passed her tongue attentively over her lips; when she licked some one's cheek; when her hand touched her own cheek and trailed over it to her mouth; when she groped with finger-tips across our dresses, or her tray; when she fumbled at an object to get a good hold. Considering the variety of experience yielded by smooth or rough, cool or warm, soft or hard surfaces, it is noteworthy that the interest shown in them was so slight,—barely enough to show that they were noticed, so far, at least, as the hand was concerned; and even the more delicate perceptions of the lips and tongue seem rather to have given mild pleasure than to have aroused the curiosity and effort to apperceive which seemed needed in the visual field for all steps of progress.⁵⁹

5. EARLY TACTILE-MOTOR INTERPRETATIONS.

Direction and Position.—There must have been some data toward these interpretations in the baby's consciousness, in the period just preceding visually guided grasping; but they were certainly not sufficient for any real interpretation, at all generalized,—unless, perhaps, the constant relation of the parts of the mouth, as perceived both by tongue and fingers, had given something that might be called an idea of the position of the parts and their direction from each other. But I saw no sign in the first half year that these relations had attracted attention; it was at a later period that the mouth was intelligently explored, with an evident attempt to organize and comprehend the touch perceptions. Again, the constancy with which the finger-tips

⁵⁹ The same indifference to tactile experiences, as compared with visual, has been noticeable in my nephew. Mrs. Tilley's younger boy, who began licking objects a good deal about the 7th week, seemed in the 12th to be "investigating things" in this way. See also p. 96, note 60.

encountered the palm on closing, and the upward movement of the hands found the mouth, must at least have prepared the way for the feeling that these bodily parts occupied a definite place. Direction up and down in arm movements must have been marked by difference in gravity feelings; the movement toward the mouth by a sort of foreshine of mouth pleasures, which were lacking when the arm moved in any other direction; so, too, the movement across the tray to lay hold on a familiar object. But in all this there is rather the mechanical repetition of a familiar movement to obtain familiar sensations than any incipient inference of direction, such as led the baby in the thirteenth week to turn and look intelligently for a person who had gone out of her field of vision. Indeed, it would seem *a priori* an impossibility that a feeling of direction and position could be experienced before the feeling of a continuum of some sort in the external world had been reached; and this feeling, so quickly attained through the eye, could be reached through touch only after a large and varied accumulation of experiences. This accumulation once made, there is ample evidence (from cases of persons born blind) that tactile-motor perceptions may reach a high psychic value with no aid from sight, may be systematized into an excellent understanding of form, of direction, position, and distance, and give an even clearer sense of the objectivity of the external world than the eye can give.

Distance Estimate.—The adjustment of muscular action to distance had become accurate for two or three well-practiced movements,—the hand to the mouth, the mouth and hand to meet each other, at least; and the latter was a complex adaptation, swiftly and accurately made. Yet here is probably only a muscular adjustment of the same order as that of the eye muscles in fixation or in accommodation; adjustments directed by muscular sensation, it is true, but not developing into an *estimate* of distance in terms of muscular sensation, until attention had been bent on the changes produced in phenomena by them, and these changes had been reduced to some primitive mental order. Such an apperception of distance, like that of direction and position, required a much larger accumulation of

tactile-motor experience than the baby possessed as yet; and I think we are justified in concluding, not only *a priori*, but from the absence of attention and curiosity in her behavior, that the interpretation had not dawned.

Identity of Objects.—For this inference, too, some data existed. Consider, for instance, the sensations given by a rattle, which the baby often grasped and carried to her mouth,—a wooden shaft, with a sleigh bell on one end and a nipple on the other. At one time her finger-tips grazed the sleigh-bell, and a smooth, cool surface was perceived; at another she grasped the shaft, and felt the contact of the wood across a strip of palm and finger surface; she lifted it, and sensations of weight were added to those of contact; again, it was perceived by means of indefinite light thumps about the lips, then of more extensive pressure, moving across them; and, finally, as the complex feeling given by the nipple held and sucked in the mouth. Detached and unrelated as these different presentations of the rattle were, incapable of giving an idea of the rattle as a whole, it needed only that the baby should make an attentive tactile-motor investigation of the object,—turning it, balancing it, feeling it all over and about,—to bring them into continuity and associate them firmly into a group which (as actually happens in the case of the congenitally blind) should ultimately fuse into the perception of an object, one and identical.

But, as I have said, this attentive handling had not yet taken place, and did not take place till after visually guided grasping was established; I find no evidence whatever, in any record, of its appearance before that epoch. I can not see, therefore, how the rattle can have been as yet anything but a number of unrelated phenomena. I think we must conclude that in the case of seeing children, the hand does not learn to give any report of objects as such until its tardy interpretations have been anticipated by being caught up into one current with the more advanced visual ones. When the baby gropes across her tray for an object, grasps it without looking at it, and carries it to her mouth, it is hard not to imagine her state of consciousness just like our own, should we perform the same action with eyes

turned away. But a little consideration shows that this is impossible. She has no data from which to form an idea of an objective rattle to be sought,—it has not existed to her tactile consciousness except as certain contact and weight perceptions; nor of an objective hand to grasp it, nor arm to lift it, nor mouth to receive it,—these have existed only as recurrent perceptions of touch, and of the movement of her own muscles; and all these perceptions unlocalized in space. The transaction is only a series of tactile and muscular perceptions, strung together on a chain of association, so that each step in sensation is able to suggest the next step in movement,—with the help, no doubt, of ideas that arise, representing the coming pleasure of hand and mouth.

About the mouth alone it is possible that perceptions were more highly organized. The various sensations yielded by the mother's nipple, and by the baby's own thumb, when received into the mouth, must have come into firmly associated groups, which were recognized and represented as separate wholes before the middle of the fourth month. But it was by a sort of mechanical associative process, and I doubt if it involved any real step toward the interpretation of objective identity. There was no intelligent perception of the different touch aspects, so to speak, of thumb or nipple, no attentive effort to apperceive them as belonging together, such as that with which the baby wonderingly identifies the different visual aspects of an object (p. 74).

That remarkable visual advance, it is true, took place a little later than the date of which I have been speaking, and after the convergence of sight and touch upon objects had begun; but it was none the less a purely visual-motor one, unaffected by touch associations. As I said in relating it (p. 73), the synthesis of the two association series was gradual (sight and touch converging at first only upon a few, near objects, and even upon these most imperfectly, for several weeks), and during a period covering perhaps the fifteenth to the twentieth weeks, the visual-motor associations continued in a remarkable independent development, vividly interesting to the baby herself. I have

scrutinized my notes closely for indications of any similar independent advance in the tactile field during this transition period. I find none, unless the increased skill and promptness with which a few familiar objects were carried to the mouth indicated a sort of discrimination among them, a recognition of the special demands of each, which implied an advancing association between the different tactile presentations of each (I, pp. 313-316).⁶⁰

6. SUMMARY AND TABLES.

The development of the active use of the touch-organs, then, was as follows:—

First: During the first three weeks of life, both hands and lips closed on objects by simple reflex movement. Spontaneous movements of the arms tended to bring the hands often to the sensitive tactile region of the mouth.

Second: In the 4th week rudimentary grasping with the lips appeared, perhaps by associative suggestion from experience of the breast in nursing.

Third: In the 7th week active touch was exercised by the tongue.

Fourth, Fifth, and Sixth: During the 9th to the 12th week, three parallel developments were taking place:—

Active touch in the fingers;

⁶⁰ Mrs. Moore, Mrs. Beatty, and Mrs. Tilley record an advancing interest in active touch during the transition period; attentive hand investigation of surfaces (not of forms) thus beginning before the eye had really come to aid it. An interesting note by Mrs. McLeish shows that while visually guided grasping was still most uncertain (18th week) her baby could reach out with eyes closed for the nipple, located by tactile-motor memory, and grasp it with precision and promptness. In these cases there must have been a further advance toward the development of purely tactile-motor interpretations of form, distance, and direction, as well as more advanced perceptions of surface, than in my niece's case.

The brandishing of rattles and bells that is reported at this period, in my own notes and in others, the rustling and tearing of paper reported by Mrs. Hall, are also instances of the use of the hand to obtain sense-pleasure directly, instead of merely as servant to the mouth; but here the pleasure consists rather in the muscular and auditory sensations than in those of touch.

Grasping with the hand, directed by purely tactile-motor associations;

Carrying the hand voluntarily to the mouth, to suck the fingers and thumb.

Seventh: In the 12th week appeared a well-developed mouth-grasping, by movements of the head, directed by purely tactile-motor associations.

Eighth: In the 13th week objects began to be voluntarily carried to the mouth.

Ninth: A practice period followed, 13th to the 17th week (and beyond, running on into the period of visually directed grasping), in which the chain of tactile-motor association by which objects were groped for, grasped, carried to the mouth, and there felt over and sucked, was perfected.

Tenth: From the 7th week perceptions of surface were received, and by the fourth month they must have been fairly clear and somewhat varied for the tongue and lips, but most rudimentary for the hand.

Eleventh: Some fragmentary data toward interpretations of direction, position, distance, and objective identity existed by the end of the fourth month; but they were far more meager than those gathered in the visual field, and as they do not seem to have been attended to or apperceived, it is unlikely that such interpretations had begun to be made, even in the most rudimentary fashion, until they were aided by the eye.

We may see here essentially the same synthesis as that already traced in the visual field, if we keep in mind the mouth, not the hand, as the touch organ at this period. The movements of the hand and arm so far are to be classed with those of the neck, lips, and tongue, as directed merely to bringing the stimulus into contact with the surfaces of highest tactile sensibility, exactly as the movements of the eyeballs and lenses, and of the neck (and to a considerable extent even those of the trunk in straightening up the back), are directed to bringing the visual stimulus into contact with the most sensitive portion of the retina.

Thus we have to begin with, the *passive sensibility to touch*

in the lips and tongue, and the *automatic movements* by which stimulus is brought to these organs; then *association groups formed under direction of the feeling of enjoyment* between the tactile-motor sensations⁶¹ that result from these movements and the muscular sensations that accompany them; until representation of touch pleasures to come (or even the mere craving of the organs for their proper stimulus) is able to suggest the voluntary repetition of the movements.

Supplementing this, we have a second association-group, formed in the same way between the tactile sensations of the hand and the movements of reaching and grasping, and linked to the first group through the association of the muscular sensations of the arm with both. But the hedonic quality of the hand perceptions is still so slight that this second group is psychically only an auxiliary of the first, devoted merely to increasing the variety of touch stimuli presented to the principal touch organ.

Thus touch has become an active sense, intelligently directed to the exploration of the objective world in search of sense-enjoyment, just as perfectly as sight; to a far more limited extent, it is true, but only because its ability to get at stimuli is so limited, while the child is unable to move about, and the ministry of the hand is still so imperfect. If vision did not come in at this point to direct the hand, the child would soon learn to grope and seek with diligence, and would obtain great variety of touch sensations; but so far there is but the least rudiment of seeking, and the sense satisfies itself with constant use of the one source of stimulus that lies always at the infant's command,—his own thumb and fingers,—and such meager supplementary objects as come to hands and mouth almost unsolicited.

⁶¹ These are not wholly sensations of touch, since the group of sensations, tactile and muscular, involved in sucking seems to be the great source of enjoyment. This complicates the analysis of the touch-motor associations a little; for instead of having a series of hedonic touch sensations on the one side associated with a perfectly parallel series of neutral muscular sensations on the other, we have on the hedonic side both tactile and muscular sensations to be associated with the parallel series of neutral muscular sensations, on what may be called the utilitarian side of the association.

A comparative tabulation of the reports of different observers on the stages by which the use of the touch-organs is attained, presents great difficulties. Variations in the order of overlapping among the developments of hand, arm, mouth, and neck, do not affect the real similarity in essentials which the records show; yet they obscure it greatly in a chronological table. Again, most stages of the development are gradual, covering several weeks, and it is often impossible to tell whether a note refers to an early or a late phase of the process. Nevertheless, for the sake of gathering together the available data on the subject for reference, I gave a tabulation (IX(a)) in which my own results are compared with those of the other fairly consecutive records, and annotated with the fragmentary items I find elsewhere.⁶² From this somewhat confused table and accompanying notes, by setting aside the most precocious and most tardy instances, we may sift out the points of substantial agreement presented in Table IX(b):—

All records agree as to the absence of marked interest in hand sensations; as to the centering of the whole series of associated movements upon the tactile-motor sensations of the *mouth*, the high degree of comfort afforded by these, and the persistence with which they are sought; yet the absence of signs of lively pleasure or intense attention excited by them is noticeable.

During this whole period the baby had, of course, frequent experience of concurrent tactile and muscular sensations in other parts of her body, besides the hand and mouth region; but neither by signs of attention nor by the attainment of con-

⁶² See also I, pp. 399-405, Tables III-VI. The record in my nephew's case is continuous, but made too late to incorporate into the table. I append it here:

8th week: Grasping with mouth, on touch suggestion.

10th week: Active touch with tongue and lips.

11th week: Active touch with fingers.

Directing hand to mouth.

12th week: Longer and more attentive holding.

Reaching with head and neck to grasp.

13th week: Grasping with hand on chance contact.

15th week: Intelligent tactile-motor grasping with hand.

16th week: Beginning of carrying objects to the mouth at will.

trol over her movements did she show that association groups were formed among these sensations,—except as tactile sensations entered somewhat into the group by which the nursing

TABLE IX(a).
DEVELOPMENT OF ACTIVE TOUCH AND TACTILE-MOTOR GRASPING.

Age of Infant.	Stages of Development, Observed by			
	Shinn.	Tilley.	Hall.	Moore.
1st 3 weeks.	Passive sensibility to touch. Reflex closing of mouth and hands on objects placed in them. Spontaneous arm movements, tending to bring the hands near the mouth.			Getting hold of nipple with mouth, 4th day ⁶⁶ (girl), 3d week (boy).
4th week.	Grasping with mouth (upon touch suggestion?).			
6th week.		[2d boy.] Longer and more attentive holding; clasping movements repeated.		Longer and more attentive holding.
7th week.	Active touch with tongue. ⁶³			Grasping with hand on chance contact.
8th week.		Active touch with fingers (?)	Directing hand (thumb) to mouth, 1st efforts.	
9th week.	Longer and more attentive holding; ⁶⁴ fingertips held together.		Longer and more attentive holding.	Reaching with head and neck to grasp.
10th week.	Directing hand to mouth. ⁶⁵ Grasping with hand on chance contact. ⁶⁷			Active touch with fingers. ⁶⁸ Directing hand (thumb) to mouth (both children). Intelligent tactile-motor grasping with hand.
11th week.		Grasping with hand on chance contact.		
12th week.	Active touch with fingers. ⁶⁹ Hand (thumb) skillfully directed to mouth. Intelligent tactile-motor grasping with hand. ⁷⁰ Reaching with head and neck to grasp.		Objects carried to the mouth.	
13th week.	Beginning of carrying objects to the mouth at will. ⁷¹	(1st boy.) Active touch with fingers. Putting things in mouth. Directing hands to mouth	Intelligent tactile-motor grasping (?) (Op. cit., p. 396.)	
14th week.	Persistent practice in feeling for objects, carrying to mouth, and there investigating by active touch, as well as sucking.	Intelligent tactile-motor grasping with hand, both children (2d child possibly as early as 11th week).		

position was recognized (p. 54), and the groups experienced in sitting up (I, pp. 326-329), and in kicking for pleasure (I, pp. 188-189). But as neither of these association groups played an important part in that synthesis of sense experience by which the outer world became known, I need not dwell upon them here.

"This seems to have been seen early by Mrs. Moore, but she has not given the date.

"Preyer mentions the same act as usual a few days after birth, but cites no direct observation. It can not, of course, be regarded as anything but a reflex at this age.

"Mrs. Saunders (MS. notes) records this in the 5th week; Prof. Preyer not till the 14th week—no doubt in the one case an incipient phase of development, in the other an advanced one.

"Mrs. McLeish's little girl learned from the 7th to the 10th week to carry the thumb directly to the mouth; Mrs. Saunders reports the movement well learned by the 14th week. Sigismund saw the fingers carried to the mouth "toward the end of the first quarter-year."

"Mrs. Moore reports grasping on chance contact, in the case of her girl, on the 14th day, but this can scarcely have been anything more than the primitive reflex. Mrs. Emily Fogg Meade, in a letter, mentions a grasping that seems to be of the more advanced, but still largely mechanical type (p. 82) in the 9th week; Mrs. McLeish records in the 10th week grasping that may be of this type, but has some traits of intelligent action (*op. cit.*, p. 118); Preyer saw what he regarded as intelligent grasping upon chance contact in the 12th to 14th week.

"Dated 10th week, *op. cit.*, p. 16, and 11th week, p. 74.

"Seen by Mrs. Daniel also in the 12th week.

"The grasping seen by Sully in the 11th week should probably be classed here (*op. cit.*, p. 13); so also, perhaps, that noted by Mrs. Beatty in the 16th week.

"Darwin notes carrying objects to the mouth 12th or 13th week; Tiedemann about the same date; Sigismund, "toward the end of the first quarter-year"; Mrs. St. John in the 12th week; Mrs. Conard in the 18th; Mrs. Wood at 3 months old for one boy, at 4½ months old for the other; Mrs. Beatty in the 15th week; Mrs. McLeish in the 17th week. All these notes seem to refer to voluntary conveyance of articles to the mouth, for the sake of the sensations, not to the early accidental lifting thither of articles that chance to be in the hands. Mrs. Moore notes precocious isolated instances of what looked like voluntary effort to carry something to the mouth, as early as the 4th week (girl), and 5th week (boy); and I noted one in the 7th week (p. 86, note).

TABLE IX(b). TABLE IX(a) CONDENSED AND GENERALIZED.

AGE OF CHILD.	TACTILE-MOTOR DEVELOPMENT.
First six weeks	New-born condition of passive sensibility and automatic movement. Toward the end of the first month, grasping with the mouth, by associative suggestion. ¹²
Sixth to ninth week	Active touch with the tongue well developed; no doubt incipient earlier. Incipient signs of active touch and grasping with hands.
Eighth to thirteenth week.	Active touch with fingers well developed, but not important for direct sense pleasure till later. Directing hand to mouth, and presenting thumb to insert, acquired by practice. Grasping on chance contact, quite mechanically, but apparently by associative suggestion, not pure reflex. These three developments vary considerably in order of appearance, having no genetic relation to each other, though they co-operate.
Tenth to fourteenth week.	Objects laid hold on with some degree of intelligent adaptation, and soon even felt for and reached after, without visual aid. Advanced and skilful reaching with head and neck to grasp, co-operating with hand and arm, under guidance of purely tactile-motor associations. ¹³
Thirteenth week on	Objects carried voluntarily to the mouth.

III. SYNTHESIS OF THE VISUAL-MOTOR AND TACTILE-MOTOR ASSOCIATIONS.

The manner in which the visual and tactile perceptions coalesce, and the object of sight is identified with the object of touch, seems quite clear. All observations agree in indicating that it is in watching the hand, or the object held in the hand, that the identification is made. There must, of course, be other ways to the same end, for no one can doubt that a handless child would sooner or later make the identification; the handless animals make it readily. I venture to think that even in the case of the normal human child some beginning has been made in recognizing the object of vision as the object of mouth-touch before it is recognized as the object of hand-touch. But the remarkable fitness of the hand to afford simultaneous

¹² Comparative observations lacking, yet the stage is probably common and normal.

and parallel experiences of an object to sight and to touch, brings it quickly to the front in the psychological process, and carries this process to an extent that can hardly be possible without hand investigation. Mouth investigation can only associate the object seen with the object felt by *successive* experiences of it, a very different thing from simultaneous ones. One may question whether a hoofed quadruped, unable to feel an object while looking at it, and to see himself feeling it over, does ever actually reach a perception of objects as such, like ours.

1. INCIPIENT ASSOCIATIONS OF THE OBJECT SEEN WITH THE OBJECT TOUCHED.

When the infant recognizes a face (usually in the third month, see Table VII, p. 68), some association has certainly taken place between the visual appearance of the person recognized and the other experiences that have been received from him. There is here no definite association of the sight of an object with the "feel" of it, but only with a complex of experiences, among which tactile ones are included,—or, perhaps, not even with that, but only with a revived hedonic feeling.

The sight recognition of the nursing bottle, breast, spoon, or cup, about a fortnight later (p. 68, note), is a decided advance toward identifying the object felt with the object seen. We certainly have here a case in which the visual experience is able to suggest experiences in other departments of sense quite definitely,—experiences of taste and of the satisfaction of hunger, mainly, but also tactile experiences. This recognition is reported by a few observers as clearly prior to the convergence of visual and tactile attention on the hand;⁷³ but in the majority of cases, as in that of my niece, it was later.

⁷³ *Op. cit.*, Sully, p. 405 (10th week); Mrs. Hall, p. 524 (13th week); Mrs. Moore, p. 47 (12th week); Mrs. Tilley, MS. notes (12th week). Yet a remarkable note of Mrs. Hall's (*op. cit.*, p. 394) shows how feeble the association was, nearly a month later: "In the 16th week, when held close to the breast, he often slipped his thumb into his mouth under the impression that he had the breast, but became impatient when he found that it yielded nothing. In the 17th week the breast was shown him while he still held his thumb in his mouth, and then for the first time he seemed to realize that the two were separate and that he must release his thumb before

2. WATCHING THE HAND MOVEMENTS.

Soon after the mastery of the full mechanism of vision, and of some voluntary use of the hand, while attentive visual exploration is going on, the hand and its movements naturally fall under observation, along with other objects. The correspondence between the feelings of movement in the hand and the changes in the visual image seems to arouse the child's attention, and to establish quickly an associative connection, by means of which the movements of the hand are voluntarily practiced for the benefit of the eye. Here the association is mainly between visual and muscular perceptions, but the touch of the hand upon itself or against neighboring surfaces must be more or less perceived as it is watched.

This stage did not occur in my niece's case. It is mentioned by so many mothers that I watched for it carefully, and in vain. But it is abundantly recorded by others,¹⁴ and falls

obtaining the breast. Up to this time the thumb had been removed for him, but on this occasion no assistance was given until he himself had made an effort to remove it and had failed. He looked at the breast, then worked at the thumb, then cried, but could not take it from his mouth. He was thereupon assisted and given the breast. Each time he nursed he was required to make an effort to remove the thumb, and was afterward given such help as was necessary. Late the next day, after a long trial and some crying, he succeeded in his efforts, whereupon he made a little sound of satisfaction and seized the breast. Six days later he was able to remove the thumb at will and with ease."

"Mrs. Tilley records of her older boy, in the 14th week (at which date he already felt for and grasped objects) "Spends a good deal of time looking at his hands, turning them over wonderingly." The note "wonderingly" shows that attention was awakened, and an effort to apperceive the sense phenomena was taking place. Three weeks later this boy was grasping at objects seen. Of her second boy, Mrs. Tilley records at 18 weeks, "Has looked at his hands." At 3 months: "Has gazed at his little hands a good deal. Sometimes lately when he has hit something with his hand, he will look first at one, then at the other, sort of puzzled, and I have fancied that he tried to see if he could do it again. At any rate, he looked in wonder at his hands when he hit the chair or paper." Four weeks later, the child was grasping by visual guidance.

Sully's boy in the 9th week "was surprised in the act of surveying his own hands." This early survey seems to lead to no association—the hands are looked at as any other object would be. But when the boy was a little over 4 months old, and already able to grasp an object felt for, "He would now bring his two hands together just above the level of

always at the same period, just after the full mastery of vision and of some voluntary use of the hand, and just before the beginning of true visually guided grasping, usually in the fourth month.

3. LOOKING AT THE OBJECT HELD IN THE HAND.

It is evidently in looking at an object while touching it with the hand, and in giving attention to both presentations of the object, the visual and the tactile, that the identification of the two worlds of sight and touch is most easily reached. In the fifteenth week my niece began to look at her hands in the act of

his eyes and then gaze on them attentively, striking out one arm straight in front of him, and upward almost vertically, as if he were trying some new gymnastic exercises, while he accompanied each movement with his eye, and showed the deepest interest in what he was doing. By such exercises we may suppose he was exploring space with hand and eye conjointly and noticing the correspondences between looking in a given direction and bringing his hand into the line of sight." Within the next month the boy began to make efforts to grasp an object seen (*op. cit.*, p. 413).

Mrs. McLeish's daughter, on the 88th day, "noticed her hand for the first time. She lay for 30 minutes looking at the right hand, twisting and turning it. The next day she made her first effort to grasp, using the right hand. [Real grasping at sight was not attained, however, for more than a month after that.] Four days later she first looked at her left hand. After playing with it for some time, she brought her two hands together with much effort, the fingers just touching. For several weeks after that she played with her hands a great deal." (*Op. cit.*, p. 111.) These weeks of playing with the hands were just the ones in which grasping at objects seen was slowly learned.

Mrs. Saunders's boy, in the 15th and 16th weeks, "would seem interested for minutes at a time holding his hands up in front of him as he lay, and slowly turning them over and over, and scrutinizing them most carefully." Soon after this he began to grasp; I can not quite fix the date from the note. Mrs. Cook's boy at 4 months "notices the moving of his own hands, and has been seen to watch them intently while he slowly moves his fingers." Apparently this boy was grasping at 5 months old, though the note is not quite clear. Mrs. Daniel's daughter in the 10th week examined her hands carefully, and at 4 months reached intelligently for what she wanted. So, too, Mrs. Daniel's other children, E. Schulte's child, mentioned by Preyer (*op. cit.*, p. 47), Mrs. St. John's, and Mrs. Moore's children, all surveyed their hands noticeably, some time between the 3d and 4th months. Mrs. Catterall's boy, in the 12th week, looked persistently at his fingers *cross-eyed*, but this must have been a purely visual experiment, to see the fingers doubled by focusing too short.

grasping, and at the objects in them; her manner was blank and uncomprehending as she did so, and yet the touch of an object against her hand did seem to suggest turning her eyes toward it, as well as laying hold of it with her hand (I, pp. 312, 313). This began just a fortnight before the first effort to lay hold of an object seen. In the early stages of visually guided grasping, when the association between the object visible and the object tangible was still feeble, watching it while laid hold of continued to be a great aid in identification.

There is no lack of confirmation from other records⁷⁸ as to the disposition at this stage (just before grasping the seen object, or in the earliest uncertain grasping) to watch the process, or to bring into visual range an object already laid hold of without visual help. In this latter case the tactile perception has become able to suggest a movement that will produce a visual one; in the case of grasping at the object seen, the visual perception has become able to suggest a movement that will produce a tactile one.

⁷⁸ Mrs. Tilley's younger boy (who at 3 months gazed wonderingly at his hands when they struck against chair or paper, and looked from hand to object), in the 16th week would look at his rattle "critically" as he held it, and would pull up his blanket and look at it; in the 17th he scratched at a pillow beside him, and watched his fingers while they scratched, and clasped his hands together, and felt of one and then the other, as if it were a new feeling; in the 18th he laid hold by feeling of various objects near him, and watched both hand and object. This was upon the very eve of visually guided grasping, which began in the same week. Mrs. Moore's boy as early as the 10th week, Mrs. Daniel's in the 12th (both these were precocious children), and Mrs. Catterall's at 14 weeks, would lay hold of their dresses and bring them up to be looked at. Mrs. Hall's boy in the 10th week, when his hand was tapped with a pair of scissors, watched both the hand and the approaching scissors; but this seems to have been too early to fix any real association between the object seen and the object felt. Later he seems to have obtained a sort of preliminary practice for grasping by learning to pull a handkerchief from over his eyes, to pull his long dress over his face and off again, etc. Mrs. Moore's boy at 3 months watched his own grasping, and at 4 months took pleasure in feeling of everything in reach. My nephew began at 3 months to watch his hand and the object in it, while trying to get it into his mouth, though so short a focus was evidently hard for his eyes; in the 15th week, he would pull up blanket or dress with both hands and look at it; and in the same week began to make efforts to touch, or grasp, at sight of objects.

4. MOVING THE HAND TOWARD THE OBJECT SEEN.

There seems to be a good deal of evidence of a stage in which the disposition to grasp is no more than an aimless movement of the hand toward the visual stimulus. Certainly in the earliest grasping there is no such thing as a conception of an *object*, visual and tangible, with real purpose to lay hold upon it. My niece, at sixteen weeks old, made fumbling movements of the hand toward objects, looking at them, or struck toward them with the open fingers, till she touched them; it was only then that the vague and mechanical manner disappeared, and she took hold with intention. Apparently she repeated the sort of movement by which she had been accustomed to grope for and obtain contact with objects, but she did it now (after a fortnight of looking at objects while laying hold of them), *upon visual suggestion*.

This new initiation of the grasping action by visual suggestion seems to come by a natural process of association from the habit of looking at the object while grasping, and it is probably stimulated by representation of touch pleasures. But as to the ability to give the hand its *direction* toward the object we may have to credit something to an inherited and automatic adjustment. In the acquirement of the so-called "instinctive movements," individual experience and inherited tendency act and react quite intricately. In the first indefinite movement of the hands toward the object seen, there may perhaps be something of the primitive tendency to automatic movement toward the source of stimulus (p. 37). But by a perfectly traceable process this visually stimulated movement becomes associated with the voluntary gropings of tactile-motor grasping, so that the visual stimulus that discharges the one is able to suggest the other. With this, a gap is leaped; the eye can take the guidance of the hand, and a process of practice begins again, in which the mere impulse of the hand toward the object seen develops into real reaching for it and grasping it.

Some such combination of practice and instinct seems to me indicated by the records of others as well as by my own. "*Trying to grasp*" is repeatedly mentioned at the very outset of

visually suggested grasping. In the note below⁷⁶ I cite several

"1st day of 5th month.—This morning we noticed the first reaching to grasp something. I held out the rattle; up came the little hand, but he began to open his fingers at the same time, and then stretch out the arm. He did not find the rattle, but he was looking at it and trying to." MS. of Mrs. Tilley.

"[On the 89th day] the green ball was hung from the top of her basket. . . . She lay looking at it for several minutes, then slowly and steadily her right hand was raised toward it with fingers extended. I lowered the ball, and again, after an aimless play of from five to ten minutes, the hand was raised as before. The right hand only was extended, and each time it was raised first to the mouth and then put out slowly and steadily toward the ball, with the fingers extended ready to grasp. It seemed as though the baby's first instinct, when she became conscious of her hand, was to bring it to her mouth, as in thumb-sucking. . . . [94th day.] This morning a great effort was made to grasp the ball. The whole body quivered with excitement, the tongue was frequently extended, lapping the lips. The ball was several times hit, but not grasped. Her reach was still a little short, and even when her hand was beside the ball her fingers did not close over it. On the 116th day there was still not much progress made in grasping. I held an ivory ring with silver balls in front of her, within easy reach of her hand. She tried to grasp it, but could not put her hand from her sufficiently. When she is eager to seize something, her hand seems to be involuntarily drawn toward her. In this instance she brought her hand first to her mouth, as in grasping for the ball, and then reached it out toward the ring, but unsuccessfully. When I put the ring into her hand she seized it, and carried it at once to her mouth." Mrs. McLeish, *op. cit.*, pp. 118, 119. This is not the manner of action that takes place when a real association has been established between the feel of the proper movement and that of the desired sensation, and the movement, imperfectly made, needs only to be perfected by practice. It is just the sort of action we should expect, if the sight of the eye has become able to suggest touch desire, and to initiate an unintelligent out-thrust of the hand toward the stimulus. Four days after this ineffective effort at visually guided grasping, the little girl, losing the breast from her mouth, reached out her hand, seized it, and put it into her mouth, without opening her eyes; "there was not the slightest hesitancy either in grasping it or in bringing it to the mouth." This was tactile-motor grasping; and a few days later, after being practiced a little in recovering the nipple of her bottle (removed from the mouth) by tactile-motor grasping, she repeated the same act correctly at sight of the bottle—obtaining thus, by repetition on visual suggestion of an act already familiar on tactile suggestion, the missing link in association; and in a fortnight more she began really to grasp under visual guidance.

"The brass knob on the bed was the first thing reached for. Date not given. The first time he was held near it, he fixed his eyes on it, became excited, making movements with the whole body, not in the direction of

passages that seem to indicate no real effort to get hold of an object, but rather mere movement toward it, stimulated by memory of touch-pleasure, suggested by a sight which has become associated with that memory, but *not* guided by any acquired idea of the act to be performed. That is, the muscular

the knob, but vague wriggings, the eyes remaining steady. This was repeated at three different times on the same day. The third time, he waved his arms from the shoulder. The next day, the body movements and waving of the arms were repeated; this time slightly toward the knob, but he did not touch it (one trial). The third day, after this preliminary exercise, he suddenly plunged the left hand forward, and laid it directly on the knob. In the previous efforts the hands had moved together, or nearly so. This play was repeated daily, often several times a day. After his first success he grasped it readily, at the first effort. No assistance was ever given him beyond holding him steady at reaching distance." MS. of Mrs. Cooley.

"The next noticeable advance took place at the end of the 19th week. The boy's father held a biscuit (the value of which was already known) just below his face, and well within his reach. There was a very earnest look and then a series of rapid, jerky movements of the hands. These were uncertain at first, but on repetition of the experiment grew more precise. At first the biscuit was dropped. . . . But after repeated trials he managed to hold on to the treasure and bear it triumphantly to his mouth. The discovery of the new delight of feeding himself led to more violent efforts to seize the biscuit when presented again." (Sully, *op. cit.*, p. 414.) It was not till the boy was six months old that this incipient grasping developed into good grasping, "involving a perception of distance."

"9th week.—Incipient reaching was observed, the hands moving toward the object upon which the eyes were fixed." Mrs. Moore, *Comparative Observations of Movements*, p. 4. This seems to indicate (as in so many of Mrs. Moore's notes) some very early and automatic form of the movement, for it was not till the 18th week that this child (a daughter) is noted as having fairly acquired the reaching habit and adjustments. In her record of her son, Mrs. Moore speaks of the trembling, uncertain movement in the first grasping, and mentions that in the 17th week the object was sometimes struck by the back of the hand, and the child was then able to turn the hand and grasp—just as my niece seemed only to know what she was going to do when the hand had touched the object, and tactile association came into play.

"109th day.—When a vase containing a single yellow flower was placed on the table before him, he became much excited, making motions with both hands toward the flower. The motions were illy directed to be sure, but he nevertheless succeeded in obtaining a hold upon the vase with the right hand, and in maintaining it until he had worked the hand up and procured the flower." Mrs. Hall, *op. cit.*, p. 396. Apparently the child merely moved both hands toward the object, till one touched, and tactile-

sensations of the proper movement have not come into the association group through practice, and the action is not intelligently directed. Yet some of the notes give evidence enough that attention and mental effort were involved.

In my niece's case five days of getting hold of objects "by a kind of vague clawing at them," looking at them the while, seems to have brought the movement sensations necessary to the direction of the arm into association with the visual and touch sensations, and the reaching out and grasping began to be intelligently performed by the 118th day,—began to be, but for a fortnight more, up to the end of the nineteenth week, the manner of grasping was doubtful; it was still to a great extent *feeling for* the object, without much dependence on visual direction (I, p. 315).

During this time grasping with the mouth upon visual suggestion was much more prompt and confident.^{76a} This began with finding the nipple by sight, the repetition of a movement often

motor grasping came to his aid. It was not till the 126th day that he grasped unmistakably, directing his hand.

Mrs. Beatty's boy in the 17th week "seemed trying" to get hold of something, and did not clearly reach for objects until the 18th week.

I note of my nephew, in the 15th and 16th weeks: "The sight of a hand, moving about in his easiest range of arm movement, seems to stimulate a vague motor disposition in his hands,—they move in a pawing sort of way, while he looks at the object, but there is no visual guidance; if they chance to touch the object conveniently, it is laid hold of." The whole process was always watched carefully by the child. In the 17th week, I thought that his manner in this pawing toward an object indicated some real desire to get at it, and that it was determined partly by mere overflow of excitement into the familiar flexions and extensions of the arm muscles, and partly by memory of former successful movements, which had been at once watched and felt. I thought also that I detected some element of effort to reach the object by a rough trial and error method, for the movement was varied till the object was struck. There was no ability to direct the hand by the eye. From the latter part of this week, he began visibly to select somewhat the successful movements, to widen the range within which he could get at the object, and to acquire some sense of relation between visual and motor direction; but up to the 20th week, his grasping was wholly empiric, so to speak, stimulated by sight, but only imperfectly guided by it, and largely dependent on tactile-motor memory.

^{76a} So, too, in my nephew's case.

practiced, but heretofore without visual suggestion (I, pp. 315, 316); but this is not sufficient to account for the confidence and skill with which the baby dived for an object and got her mouth to it,—the element of instinctive, inherited adjustment must certainly be greater here than in the case of hand grasping. We should expect as much from the greater phylogenetic antiquity of mouth-grasping.

5. VISUALLY DIRECTED GRASPING.

As I have said just above, it was late in the seventeenth week that my niece first reached intelligently for an object and grasped under visual guidance. She was nearly nineteen weeks old before the movement took place with promptness and precision and it was not till the twentieth week that it ceased to be much aided by tactile-motor familiarity with the object and its position (I, pp. 316, 317. See also observation on my nephew's grasping, end of note 76, p. 110).

The period of free and skillful grasping is reached at about this time by every infant. In every case where detailed records are given (with one exception about to be mentioned) it has plainly been reached by a gradual synthesis of visual and tactile experience into a firm association group. The one exception is the very important one of Professor Preyer's record. This distinguished observer does not recognize any period of tactile-motor grasping, of carrying objects to the mouth, of mouth-grasping, of visual inspection of the hand or objects in it, before the time of visually guided grasping; on a first reading, one would conclude he had seen nothing but reflex clasping until the day when reaching for an object visually located suddenly appeared. Yet re-reading his account carefully, I see nothing in actual conflict with my own and the others I have cited. There was evidently some sort of "apparent grasping" after the fourteenth week, not visually guided, but not like the early automatic clasping; there was evidently in the first "efforts to seize" little more than a vague movement of the hand toward the object seen; and as for visual inspection of an object at the same moment that it was felt by the hand, it is possible that this did

take place, and would have been seen by a woman observer, occupied much of the day about the baby, holding and dressing and tending him. It seems evident from Professor Preyer's record that the baby was not supplied with convenient objects, laid or hung within reach, before grasping had been acquired; and where this is not done, the little hands, in the incipient stages of grasping, can only lay hold of folds of garments or the fingers of the attendants,—acts not so noticeable as the handling of toys."

The development of skill in grasping need not be followed here (see I, pp. 317-324). There is but one more stage of the movement to be mentioned as significant in the development of sense perceptions.

6. JOINT TACTILE AND VISUAL INVESTIGATION.

Up to the twentieth week, grasping was exercised only for the purpose of supplying touch-pleasure to the mouth. So far, the new ability to unite the use of hand and eye had merely added one more link to the long chain of associations by which a sensation received from a distant source could be transferred to the sensitive region of lips and tongue; even visual perceptions could now be transmuted into mouth-pleasure. I do not think we are justified in supposing that the baby's consciousness at this stage included any perception of an object as one thing, to be both seen and felt,—she simply followed a chain of successive suggestions and associations from perception to movement, from movement to perception.

"Mrs. Tilley records of her younger son, in the 23d week, a week after free and good grasping was acquired, "Seems a good deal older than he did a week ago. Has been a week of great advance in reaching out, and in expressing his wants." Her note goes on to describe the increased gayety, interest in sounds, appealing for attention, etc., and adds: "His whole attitude just now is—wondering eyes—'I see it!'—little hands outstretched—'I want it.' " In a later note she records that from the time grasping was acquired, the baby's general bodily movement became firm—he would bend his body, *e. g.*, to reach far off for things, "and seems to have a good idea of where they are." This swift advancement in the location of self and external objects in space, these indications of a newly clear space feeling, correspond well to my observation.

But in the twentieth week the effort to identify objects visually had been for some time going on (p. 74); on the 132d day, late in the nineteenth week, had occurred the striking incident of the baby's wonder-struck effort to unify in her mind the different aspects of a well-known head and face (p. 74); and on the same day, bending backward and touching the floor with the back of her head, she showed an even ludicrous wonder at the touch, making persistent efforts to see what touched her,—a plain sign that she had come to expect a visual image as connected with a touch. On the 133d day she sought with her eyes to find a visual image *along the line* of the direction in which it had disappeared a few seconds before (I, p. 23). An immense psychic unfolding was going on, the visual interpretations of direction, position, and objective identity were plainly developing, the junction between sight and touch had been made, and it was inevitable that her attention and curiosity, her effort to apperceive phenomena, should presently turn to the objects held in her hand, and the variety of perceptions they were capable of yielding. On the 134th day she held a rattle up before her and scrutinized it carefully,—and with that began a period of grasping for objects in all directions, not merely to carry to the mouth (though that also was done), but to investigate. It was not that touch pleasure in the hand had taken the place of touch pleasure in the mouth, as a thing sought for its own sake (it never really did this; the mouth was always the sensitive region for purely æsthetic touch purposes, and doubtless remains so in adult life⁷⁹); it was the free movement to and fro of the object under her hand, the variety of visual aspects presented by it as she watched, all answering in regular order, to the touch and muscular sensations, that gave her such an interesting enlargement of experience, so grouped together as to be apperceived without confusion.

It is impossible to overrate the importance of this epoch. In my niece's case, it was connected with a swift and most eager and joyous expansion of psychic development in all directions. Stimulated by the ability to reach for and grasp her own feet, to

⁷⁹ Groos, *Die Spiele der Menschen*, p. 13.

look for the visual source of touches, to trace direction, her acquaintance with her own body grew rapidly, and the difference between it and the environing objects, which did not yield double sensations of touch, must have begun to define itself to her with new clearness. Her desire to reach objects led not only to bending and turning, but to the first scrambling attempt at locomotion, later to develop into rolling and creeping. The persons most intimately about her had plainly become not only unified phenomena, but well associated with hedonic experience and with mental stimulus, for she turned and looked unmistakably into their faces "for sympathy" in surprise or pleasure. Such a discovery as the tangible qualities of the object visible, the visible qualities of the object tangible, such an extensive opening up of cerebral connections as that by which the visual-motor tract and the tactile-motor tract come into intelligent co-operation, must bring with it into function a great number of other inter-connections; association paths ancestrally ready open up, almost in a day, at the pressure of new tensions, and the child becomes a creature of a new and advanced order of psychic being,—all this easily within a week, it may be, and was, in my niece's case.

The period of investigating objects by eye and hand jointly runs on indefinitely in the case of every infant,—for that matter, it never ceases throughout life. "Vision and manipulation," says John Fiske, "these in their countless indirect and transfigured forms are the two co-operating factors in all intellectual progress." The reaching for, seizing, and investigating all objects in sight constituted the chief interest of life for my niece up to about the eighth month, when locomotion overshadowed it more or less. It is throughout this period of practice, running on into the second year, or even beyond, that the visual and tactile and muscular interpretations correct each other, the perceptions fuse, visual direction and direction in terms of muscular sensation come to seem objectively the same thing, solidity becomes a visual perception, and the whole feeling of space, direction, distance, depth, becomes what we ourselves experience.

It would be superfluous to cite notes from other records to corroborate my own concerning this period of reaching and investigation, for the period is conspicuous and well known in every nursery, always following immediately upon the attainment of ability to grasp by visual guidance, and preceding the period in which locomotion becomes an important interest. A few citations illustrating special traits of the period I have given already in footnotes, and a comparative table of the chronology of grasping is given below.

7. SUMMARY AND TABLES.

The organization, then, of the visual-motor and tactile-motor association groups into a single group by means of which complex perceptions of the external world in three different sensory aspects were formed, took place by the following steps:—

First: The recognition of a face (in other cases, of the breast, etc.), occurring some time in the third month, showed that a visual image had become able to suggest associated experiences in other departments of sense, among which the tactile and muscular were included.

Second: In the 15th week, through observation of the hands while in the act of grasping, visual and tactile-motor images of the same object were constantly presented at the same time. (In other cases the empty hands themselves were watched, and even moved about, for variety in the visual and tactile-motor presentations.)

Third: Through this practice, a visual image came, by the end of the 16th week, to suggest tactile-motor images (perhaps of hand contact only, perhaps of the mouth pleasures which were the goal of the whole sequence); arm and hand movements were discharged by this suggestion, and directed imperfectly toward the object,—partly, it may be, in consequence of some idea of directing the movement, obtained from watching the hand in tactile-motor grasping, but partly by an inherited and instinctive adaptation.

Fourth: Before the end of the 17th week the sensations of these seeking movements, through success, became definitely asso-

ciated with obtaining the object, and the movements were repeated with intention, yet were still mainly of a groping character. The different sense experiences of an object seem not yet to have coalesced into the feeling that it was one, and the baby in reaching and grasping merely followed along a chain of suggestion, from the sight of the object to the mouth sensations,—the link between the visual image and the first hand touch being feeble.

Fifth: At the same time, the visual image was able to suggest grasping with the *mouth*, by means of head and even body movements, more decidedly and correctly than hand grasping, and this association had probably existed earlier than that between visual image and hand grasping.

Sixth: Meanwhile, from the 12th week on, an active visual study of objects had been proceeding, and by the 19th week some progress had been made toward visual identification of them as individuals. With the beginning of the 20th week, apperceptive attention was bent upon an object held in the hand; the visual and tactile perceptions seem to have come promptly into a firm coalescence, the associative link between a visual image and the touch sensations obtainable from it was strengthened, the expectation of tangibility in visual objects was generalized, and all objects were grasped for freely and confidently, instead of an occasional one doubtfully.

Seventh: From this time, objects began to be grasped not merely for mouth pleasure, but increasingly for the complex interest of investigation by sight, touch, and muscular sense; a period of many months set in, in which the outer world was explored by eye, hand, and mouth, and all our adult perceptions of objects and space must have been slowly formed, visual and tactile-motor direction coming to be felt identical, objects to be seen as solid, and the whole external world organized as we see it.

I can not find much comparative material suitable for tabulation concerning these stages, although (as the notes above show) a number of records describe one or another stage quite fully. Many records give a date for "grasping," but I can

not tell whether it means feeling for and getting hold of objects, without visual suggestion; feeling for them on visual suggestion, but without visual direction; or good visually guided grasping. Such material as I have is collated below:—

TABLE X(a). DEVELOPMENT OF VISUALLY GUIDED GRASPING.^a

Age of Infant.	Stages of Development, Observed by			
	Shinn.	Tilley, 2d Child.	Sully.	McLeish.
13th week.		Watching own hand movements. ²⁰		Watching own hand movements. Hands moved toward object.
14th week.				
15th week.	Observation of hand and object while grasping. ²¹			
16th week.	Hands moved toward object seen. ²²	Observation of object in hand; watching fingers while touching or grasping.		
17th week.	Good mouth grasping.			
18th week.	Grasping object seen, rare and groping movement. ²³	Hands moved toward object seen.	Watching own hand movements.	Grasping object seen, rare and little guided by sight.
19th week.		Grasping object seen, rare and groping movement.	Hands moved toward object seen. Good mouth grasping.	
20th week.	All objects grasped for confidently.			
21st week.	Objects handled, not carried at once to mouth. ²⁴			
22d week.		All objects grasped for confidently.		
6th month.				All objects grasped for confidently.
At 6 months.	Mouth-grasp disappearing.		All objects grasped for confidently.	

^a See also a comparative chronological table, I, p. 405. Where these two tables differ (mainly in interpreting the notes of other records), the present one is to be regarded as the more carefully studied; but the table on p. 405 was, in any case, prepared to show the motor development chiefly; the present one, the progress in sense perception.

From the table above I have omitted Mrs. Moore's record, on account of several perplexing precocities. I give it here:—

Girl.		Boy.
9th week.	Hands moved toward object seen.	
10th week.		Looking at hand and object.
12th week.		Hands moved toward object seen.
15th week.	Watching own hands.	
17th week.	{	Hands watched while grasping.
18th week.	Grasping well established.	Grasping well established.

By incorporating the fragmentary records given in footnotes with Table X(a), and omitting a few precocious and more or less doubtful instances, I find the records in my hands are really in striking agreement so far as shown in the following summarized tabulation:—

TABLE X(b). TABLE X(a) CONDENSED AND GENERALIZED.

AGE OF CHILD.	PROGRESS IN VISUALLY GUIDED GRASPING.
Twelfth to eighteenth week (usually, early fourth month).	Watching the movements of the hand attentively; or watching the hand and object while grasping.
Fourteenth to nineteenth weeks (usually, late fourth month).	Hands are moved vaguely toward the visual object, apparently without definite idea of grasping.
Seventeenth to nineteenth weeks (early fifth month).	Grasping visual objects—movement rare and groping.
Eighteenth week to six months (usually, late fifth month).	All objects grasped for confidently.
Twenty-first week to seventh month.	Objects are handled, not carried at once to the mouth.

Although the parallel is not so close here, the general type of the development, through watching the hands, and through groping movements toward the object, before visual direction and tactile-motor direction come into unison, is evident enough.

I append also my nephew's record, made too late to incorporate into the table:

13th week: Observation of hand and object while grasping.

15th week: Hand moved toward object seen.

16th week: Fairly good mouth-grasping.

17th week: Grasping object seen, rare and groping movement.

* First child, 14th week. Watching own hands also reported 9th and 10th weeks by Mrs. Daniels and Mrs. Moore; 13th, Mrs. St. John; 15th, Mrs. Moore; 15th and 16th, Mrs. Saunders; 16th, Schulte (quoted by Preyer); at 4 months, Mrs. Cook.

* Watching hand and object, Mrs. Hall (precocious instance), 10th week; Mrs. Daniels, 12th; Mrs. Catterall, 13th.

* Moving hand toward object, Mrs. Moore, 9th and 12th weeks; Mrs. Hall, 16th; Mrs. Beatty, 17th.

* Mrs. Tilley (elder boy), 17th week; Mrs. Daniels, 4 months; Mrs. Cook, 5 months; Mrs. Hall, Mrs. Catterall, 18th week; Mrs. Beatty, 19th week; Tiedemann, 5th month; Sigismund, 19 weeks; Mrs. St. John, 20th week.

* Mrs. Saunders, 23d week; Mrs. Sharp, 29th week. I can not find definite statements in other records as to the date at which this advance took place; but that it did take place somewhere about the close of the first half-year is always made evident enough.

IV. AUDITORY ASSOCIATIONS.

The organization of auditory sensations must differ greatly from that already traced in the visual and tactile fields. For in these two fields, the essential process is the associative synthesis of two different sets of sensations,—the one set due to the impact of stimulus on the sense-organ; the other to the movements of the organ in adjusting itself to stimulus. No such synthesis can be looked for in the case of the ear, where (beyond the mere turning of the head to listen) there is nothing corresponding to active sight and active touch. In the passive reception of complex systems of stimulus (*viz.*, music and speech), the ear does attain great psychic importance; but until the brain is ready to comprehend music and speech, hearing can be little more than a warning adjunct to vision.

As I have pointed out (pp. 30–31), it is improbable that cochlear hearing exists at all in the newborn infant; and up to the 5th week I could not find indication of it; nor do I find clear evidence of it earlier than the 3d week in any record. A few instances are given, it is true, of reaction to voices, and to whistling; but these reactions were of a sort that indicated jarring or shock, and the sounds may have been sudden and harsh. With a single exception,⁸⁵ the voices were those of men, at which young babies often start as if at a jar.

On the whole, the evidence is fairly uniform that modulated tones, especially musical notes, are attended to about the end of the first month.⁸⁶ From the first time they are noticed, they give pleasure, and are therefore well adapted to enter into associations under hedonic influence. From this time, hearing

⁸⁵ Mrs. McLeish's little girl, at 14 hours old, stopped fretting when talked to in a soothing tone. In view of my own repeated failures to obtain reactions to modulated tones (I, pp. 107–108), and of Flechsig's report as to the condition of the cochlear nerve in the newborn, I think we must consider this solitary instance as mere coincidence. Since the above was in type, I find a note in Mrs. Conard's record that reports a similar reaction on the 5th day; but the incident was merely related to the mother by some one else, and seems to me quite doubtful. In any case, the reaction seen in a young infant when some one comes up and speaks to him is more likely to be visual than auditory.

⁸⁶ See Table XI, pp. 129–130.

begins to be drawn into the growing psychic complex, *not at first by the development of a series of auditory association groups, but by associations with the groups already formed in the visual and tactile fields.*

1. ASSOCIATION OF SOUND AND SIGHT.

Face and Voice.—At the close of the first month or thereabout, when cochlear hearing first begins to give pleasure, the mother's lullaby and other sounds of voices about the child supply the principal auditory stimulus. It is also just the period at which the baby has made sufficient progress in fixation to form the habit of gazing constantly and attentively at the faces that bend above him (I, p. 79). The association of vocal sounds with the sight of faces is inevitable,—the more as his attendants answer his gaze by laughing, cooing, and prattling to him. That a rude association of the sort is in fact made, is shown by the way in which babies at this stage fix their eyes on a face with marked attention *during the continuance of a sound.*⁸⁷ They are as likely to watch the eyes, the most brilliant and motile features, as the lips; indeed, my niece watched our eyes while piano notes were struck, as other babies do when they hear singing, and Mrs. Tilley noted the same thing. That is, they do not look at the face because it is the source of sound; on the contrary, it is from watching the face while hearing the sound that they come to think of it as the "source."

Other Sounds and Visual Objects.—In the latter part of the second month my niece began to watch several moving objects, while listening to the sounds they produced,—the piano-keys (or more likely, the hands moving over them), rattles shaken before her, etc. (I, pp. 108, 109). This incipient stage of the association is inconspicuous, and it is not until the baby turns his head toward a sound, shakes a rattle purposely, etc., that the observer's attention is likely to be drawn; still, I find good evidence in one or two records that such a stage does precede the actual association of the sound and sight.⁸⁸

⁸⁷ I, p. 109; see also Preyer, *op. cit.*, p. 83, and MS. records of Mrs. Tilley and Mrs. Cooley.

⁸⁸ Mrs. Tilley's boy gazed at the piano keys while hearing music (5th

Later, there appears a certain *expectation* of visual experience upon hearing any sound. My niece showed it first at 13 weeks old (I, p. 109); I find no instance of an unmistakable and well-fixed expectation of the sort before the 11th week.⁸⁹ It was not at all constant, in my own observation, before the second half-year, but some children are recorded as turning instantly to look, on hearing any sound, in the 5th and 6th months, and even by the end of the 4th. The difference may have been due to difference in interest, in keenness of hearing, or in firmness of the association.⁹⁰

Sound and Visual Direction.—But there is another association shown when a baby begins to turn and look upon hearing a sound, besides that which lies in the mere expectation of a sight: an association, namely, by means of which the quality and 8th weeks—before he had learned to turn toward a sound) just as my niece did.

Mrs. Hall has a remarkable note of the interest excited in her boy by the simultaneous stimulation of the senses of sight and hearing. "57th day.—When a rattling box of matches was held before him, he stopped fretting and looked uninterruptedly at it for 6 minutes; the rattling was then discontinued and the crying began, but ceased again at the sight and sound of the rattle-box. On the following day his attention was fixed upon it for 8 consecutive minutes. 62d day.—A purse containing coins was shaken up and down before the child. For the first 6 minutes he gazed at it with knit brows; then his face cleared; he looked pleased, then laughed and made excited motions with arms and legs. He continued this for 28 minutes, when although he did not remove his eyes from the purse, he fretted slightly. At the end of 30 minutes his eyes were still fixed upon the object, but as he seemed very tired, it was removed from his sight." (*Op. cit.*, p. 458). By a purely visual interest his attention was held at this time not more than 3 minutes. Mrs. Hall concludes: "The attention is held much more closely when two senses are affected than when only one is affected"—a condition of simultaneous tension in two sense-centers very favorable to the opening up of associative connection between them.

See also the observation on my nephew, p. 124, note 91.

⁸⁹ Earlier instances of the apparent association of a voice with expected attentions, as when the baby smiles or stops crying on being spoken to, may be due to mere diversion of attention, or to pleasure in the sound itself, or to visual suggestion, *op. cit.*, Mrs. Moore, p. 67.

⁹⁰ The *recognition* of a voice—distinguishing one from others, and associating it with visual and touch memories of the proper person—involves much more than mere association of sound and sight, and belongs to a later period of development.

of the sound suggests the *direction* of the sight, in visual space. This seemed to me to come about with surprising suddenness, without preliminary stages; yet it had the appearance of intelligent action, not of an inherited reflex (I, p. 109). It was the more surprising, since the baby had but just begun to look for objects, guided by visual memory. Dr. Stratton's experiments^{90a} have made it evident that even in mature persons there is no essential and instinctive connection between the direction from which a sound reaches us and the visual feeling of direction; that it is only by experience we learn to associate a certain quality in sound with the way in which we must turn our eyes to see its source. It is perplexing, then, that a three-months' infant could turn her head and look in the right direction, upon the first trial, at the sound of a snapping fire, a sneeze, etc.

I have no doubt that I failed to observe the early stages of the development, and other records supply the missing chapter in mine. Preyer, Vierordt (quoted by Preyer), Tiedemann, Mrs. Moore, Mrs. McLeish, Mrs. Tilley, Mrs. Hall, Mrs. Catterall, all mention the movement at first as a mere turning of the head in the *general direction* of a sound. Several observers (Sigmund, Moore, Tilley, Catterall) record the sound of a voice, or of an approaching person, as the first one that suggests this turning. Now by the end of the first quarter-year the child has already learned to look for the faces and forms of his attendants in a few familiar localities; has many times watched their faces to right or left of him, above or before him, while at the same time hearing their voices; has seen them enter and approach, at the same time hearing their steps. That the sound of voices or steps, in a few familiar localities, should suggest the accustomed image *in the accustomed place*, is to be expected, so soon as the associative connection between visual and auditory centers is at all functional; and it must be coming rapidly into function during the third month, under the tension produced by the constant attention to simultaneous visual and auditory impressions. And in fact, the first unmistakable evi-

^{90a} "Vision without Inversion of the Retinal Image," *Psychological Review*, Vol. IV, pp. 341-360 and 463-481.

dence that a sound suggests expectation of a sight, shows it suggesting also the direction of the sight, as the baby turns to look.

It may be conjectured that at first the child, at sound of any voice, looks only to the accustomed region for his mother's or nurse's face; that later, repeated experience leads him so far to associate sounds right and left, below and above, with the true direction in visual space, that on hearing a voice he turns his eyes correctly to faces *already within the marginal field of vision*; and only later extends the association, and turns his head farther in the same direction, looking for the visual "source" (that is, the expected concomitant) of sound. All this conjecture waits for further and closer observations; yet it is not wholly without corroboration.⁹¹

"By the 18th week," Mrs. Moore records, "he could locate very well sounds coming from objects *within the visual field*," (the italics are mine).

Mrs. Tilley's record of her younger boy gives the best clue we have yet had to the general process of learning the association. In the 10th week, the child occasionally turned toward a sound, once or twice only looking correctly at its source; by the end of the 12th, his mother became satisfied that the sound of people entering made him turn and look toward the door—the direction in which people had always been seen while these sounds were heard. He could not, however, look correctly toward a person speaking or calling until the 13th week. By the 18th, he located sounds quite well.

I pass over a note by another hand, relating to the same baby, according to which he looked from speaker to speaker, on the 25th day; and Mrs. Moore reports on the 30th day that her baby "undoubtedly" turned his head in the direction from which sounds proceeded. Yet these same babies are later, in their 3d and 4th months, recorded as but gradually and imperfectly learning to look in the direction of sounds. Whatever this early turning may be, it certainly is not the intelligent association of sound with the visual direction of objects. There seems to be a slight reflex tendency in the newborn, in the auditory field as well as in the visual and tactile, to movement toward stimulus. This tendency has faded away (so far as my own record or any other indicates) long before intelligent "looking for the source of a sound" is noted; but some trace of it may remain and combine with acquired experience in giving the look its proper direction; as I have suspected a similar instinctive element in the earliest grasping upon visual suggestion (p. 107).

Certainly all recorded instances of looking in the direction of a sound earlier than about the end of the 3d month, were imperfect, irregular, transitory, or were cases of the association of a single well-known sound with the invariable position of its visual accompaniment, as when my

2. ASSOCIATION OF SOUND WITH SOUND-PRODUCING MOVEMENTS.

Hand Movements.—I need not dwell on the simple associative process by which the sound of a rattle shaken, of paper crumpled, of the scratching of finger-tips across paper, etc., comes to be linked to the accompanying series of tactile-motor sensations, then to be suggested by the touch of the object, or by its weight in the hand, till the baby becomes able to repeat the movement voluntarily. My own record reports the voluntary repetition of such chance noise-making movements in the 13th week; others, usually between the 13th and 16th weeks; Professor Preyer's²² not until the 19th. It is months later, however, that the conspicuous pleasure in making a noise develops, and in all these early instances sensations of weight and of active touch are probably

niece watched the piano keys in the 9th week, or Mrs. Tilley's boy looked toward the door when he heard people enter, in the 12th.

Since the foregoing was in type, I have seen in my nephew a gradual process of association between sound and sight, much like what I had conjectured. In the 9th week I noticed that his attention was held more intensely by a visual object when he was listening to sound; the visual and the auditory experience seemed both to be noticed, and with a sort of excited curiosity, as if there were an effort to bring them into a unified perception. In the 10th week, on hearing a sound, the boy would seek slightly with his eyes, and fix them on the first noticeable object they found,—a face, a light tract on the ceiling, a bright dish on the shelf,—and regard this with intensified interest while the sound continued. But in the case of voices, I thought his manner showed a certain satisfaction if it was a face that his eyes found, and lacked it when he tried to bring the sound into connection with any other visual object. He once looked back and forth several times, as if in perplexity, between my face in the marginal field, and a bright tract on the ceiling, to which he had looked when I called him. In a few days he learned to turn, at first slowly and gropingly, then quite accurately, toward a face, and then toward other sources of sound, *within the visual field*, but not outside it. In the 11th week, I called him from just outside the visual field. He looked at the ceiling, fretted, and seemed to struggle, with straining movements of the body, to recover the missing element in the association; turned his head to and fro; then slowly and uncertainly in the right direction, till he found my face. The quality of the sound had come to suggest the visual direction without the help of the marginal image. It was not until the 19th week, however, that I saw him turn to search for the "source of sound" far outside the visual field; and then without accuracy, merely in the general quarter whence the sound proceeded.

²² See Table XI, p. 129.

sought by the movements quite as much as those of sound. But not far from the same time the infant forms an association of sound with movement which is of far greater interest to himself, and of far more psychic importance,—he learns the use of his own vocal organs.

Movements of Vocal Organs.—Before the middle of the first quarter year, 6th week, I observed that the monotonous cries of the newborn period developed into sounds much more varied, when the heightened innervation due either to pleasure or discomfort stimulated the vocal organs. By the 16th week, there was plainly voluntary effort to repeat these sounds, accompanied by a great deal of attention and enjoyment; indeed, the pleasure of this exercise was comparable to that enjoyed in visual experience. The coincidence of feelings in the baby's own throat and mouth with the ensuing sounds was evidently far more pleasurable than any production of sound by hand and arm movements,—perhaps because mouth and throat sensation was still much in advance of hand and arm sensation in the permeability of the centripetal paths and the maturity of the cortical cells; perhaps because the vocal exercises gave a more elaborate and varied set of coincidences between two departments of sense, so that the relation between effort and result attracted some real apperceptive attention, such as was already showing itself in visual observation (p. 67).

The immense importance of this stage in auditory associations is at once apparent, for it is the first step toward the acquirement of speech. It has been recorded by a number of observers,⁹³ and I have no doubt that it occurs invariably. It is, however, hard to fix the date at which the sounds become a voluntary exercise;⁹⁴ the fourth month seems fairly enough indicated, however, as the usual period (see Table XI).

⁹³ Mrs. Tilley, Mrs. Cook, Mrs. Daniels, Mrs. Catterall, Mrs. Conard, MS. records. *Op. cit.*, Mrs. Hall, p. 587; Taine, p. 24; Darwin, p. 39; Tiedemann, p. 24. Preyer, *The Development of the Intellect*, pp. 102-105, 240. *The Biography of a Baby*, pp. 87-88, 137-138.

⁹⁴ Prof. Sully hints at a process of association-forming here, precisely similar to that which I traced in detail in the visual field: first, the maintenance of a given innervation under influence of pleasure; next,

3. EARLY AUDITORY INTERPRETATIONS.

Auditory Contributions to Space Interpretations.—Any *direct* space interpretations in the auditory field must be of the most rudimentary sort, since the organ of hearing offers no means of space measurement through alliance with muscular sensations, beyond the mere turning of the neck. Our own strong feeling of sounds as arising in a definite location in space, traversing space in a line of direction, and reaching us from that direction, seems to be wholly conceived in visual-motor and tactile-motor terms, and as the result of long experience in relating given qualities in sounds to given positions of the sounding object, as shown by sight and touch. It is impossible that the baby, when he first turns to "look in the direction of a sound," or to "seek its source," can have any such secondary and transferred space-feeling connected with it; for the primary space-interpretations of the eye and hand themselves are but beginning to form at this period, the third and fourth months (pp. 71-72, 92-93).

Yet it is possible that these eye and hand interpretations do, in the very act of forming, receive a slight re-enforcement from the experiences of the ear. The differences in sound given out by a known object, according to its position or distance, especially the *changes* in sound as the object moves to and fro, advances or recedes, may emphasize the visual-motor and tactile-motor distinctions of position, direction, and distance, which

its mechanical repetition; finally, the establishment of hedonic associations, capable of suggesting the movement as a voluntary one. He says: "We see the germ of such a pleasure-seeking babbling in the protracted iteration of the same sound. The first reduplications and serial iterations, a-a, ma-ma, etc., may be due to physiological inertia, the mere tendency to move along any track that happens to be struck. . . . At the same time, there is without doubt in these infantile iterations a rudiment of self-imitation."—"As this impulsive articulation develops, it becomes complicated by a distinctly intentional element. The child hears the sounds he produces, and falls in love with them. From this moment he begins to go on babbling for the pleasure it brings." *Op. cit.*, p. 137.

So also Prof. Groos:—"Der instinctive Drang nach motorische Entladung fuhrt auch zu Bewegungen der Kehlkopf- Mund- und Zungenmuskeln, und das Kind, das sich an den so erzeugten Tönen ergotzt, ist bald in vollen Experimenten begriffen." *Die Spiele der Menschen*, p. 38.

are just becoming formulated.⁹⁵ This would be so most of all in the case of the human face and voice.

As the second half-year goes on, and the exploration of the external world by joint use of hand and eye and body movement is well advanced, the baby shows that he understands very well the difference between hearing a well-known voice at hand or in the next room (I, p. 111). In the earlier period of which we are speaking, however, there is no indication that the ear contributes anything to the inference of distance.⁹⁶ To that of direction it should, so decided is the association of sound with visual direction in the second quarter-year.

Objective Source of Sound.—At three and four months old, when objects are but beginning to be definite and located outlines to the eye, and are still only slightly associated groups of tactile-motor sensations to the hand, there can be no conception of an objective source of sound, in the sense of any notion of sounds as proceeding from, or caused by, objects. But when the infant of this age turns intelligently and expectantly to look for a located sight, upon hearing a sound, it is hard to doubt that he imports into the auditory experience something of that feeling of externality and position that the visual outline is already gathering about itself. And on the other hand, the thing seen must seem more real and external when the close association of auditory experience with it has extended that "parallax" of disparate senses on which our conviction of external reality seems so largely to depend.

Just what relation the sound tends to take to the sight in the baby's mind, it is hard to guess. It seems likely that for a time there is a tendency to fuse the auditory and visual experiences into the conception of an object visible and audible, just as it

⁹⁵ It is true that it has never been observed that deaf infants are slower in forming these space perceptions; on the contrary, it is commonly remarked that they behave so exactly like normal children that their deficiency is likely to escape detection till the period when speech should begin. It may be, however, that closer observation would reveal significant differences even in visual and tactile perceptions.

⁹⁶ Mrs. Moore says decidedly that her child at this stage could make no inference of distance from sound.

is visible and tangible. The disposition to look for a sight with every sound⁹⁷ may be due to this. If there is such a tendency, however, it must soon be broken up by the irregularities in the occurrence of sound and sight together, the association of some sounds with visual objects, others with feelings in the vocal organs, others with hand and arm feelings, while still others, from invisible external sources, remain unassociated. But see p. 193, as to interpretation of sound in the second year.

4. SUMMARY AND TABLE.

The auditory development, then, up to the period at which the main synthesis of the higher senses was accomplished, was as follows:—

First: In the newborn condition, lasting some four weeks, the baby received passive sensations of auditory jar, through the semicircular canals, from any sudden or harsh sound.

Second: From the 5th week, cochlear hearing was established, and the baby received agreeable tone sensations, especially from notes of music.

Third: Almost immediately, these tone sensations began to be associated with the visual experiences regularly received in connection with them; such associations were becoming fixed, and somewhat varied, from the 5th to the 13th week.

Fourth: By the 13th week, the differences in sounds, according to the direction from which they reached the ear, had begun to suggest the visual direction of the object, so that the head could be turned correctly to obtain the suggested visual experience.

Fifth: From the 13th week also, an association became apparent between sounds produced by hand-movements, and the feeling of these movements; so that upon touching a suitable object, the movement was suggested and the sound produced voluntarily.

By a similar association between the tactile-motor feelings of the vocal organs and the sounds produced by them, the baby became able by the 16th week to make vocal sounds at will.

Sixth: No direct auditory interpretations or inferences con-

⁹⁷ My niece, when first making vocal sounds with intention, in the latter part of the 4th month, was disposed to gaze into our faces, as if she referred her own grunts and cooings to them.

TABLE XI (a). EARLY AUDITORY ASSOCIATIONS.

Age of Child.	Stage of Development, Observed by					
	Shinn.	Preyer.	Hall.	Tilley, 1st Child.	Tilley, 2d Child.	Catterall.
1st two weeks. 3d week.	Sensibility to auditory jar, no true cochlear hearing.					
4th week.	Pleasure in musical tone.** Association of sound with face.			Pleasure in musical tone. Association of sound with face.	Pleasure in musical tone.	
5th week.						
6th week.		Pleasure in musical tone. Association of sound with face.				Pleasure in musical tone.
9th week.				Vocal sounds purposely made.		
10th week.					Looking in direction of sound, acquired gradually, 10th-13th weeks	
11th week.		Looking in direction of sound.		Sound made purposely by hand.		
12th week.						
13th week.	Looking in direction of sound.** Sound made purposely by hand.**					
14th week.						Looking in direction of sound. Vocal sounds purposely made.
15th week.			Vocal sounds purposely made.			
16th week.	Vocal sounds purposely made.**		Sound made purposely by hand.			
18th week.					Sound made purposely by hand.	
19th week.		Sound made purposely by hand.				
21st week.			Looking in direction of sound.			
22d week.		Vocal sounds purposely made.				

* Mrs. Moore, 3d week; Mrs. Cooley, 6th week or earlier; Mrs. Conard, 6th week; Mrs. McLeish, Miss Shinn (nephew), 7th week.

** Mrs. Moore records automatic or precocious looking in the direction of sounds, 5th week, but intelligent looking not before the 18th (see p. 123). Mrs. Conard saw it incipient in the 13th week, and unmistakable in the 14th; I saw it incipient (nephew) in the 11th, and unmistakable in the 19th. Mrs. McLeish records the habit as well established in the 13th week. Mrs. Wood reports it in the 3d week,—undoubtedly automatic; Sigismund “in the second quarter-year” (*op. cit.*, p. 29); Preyer quotes Vierordt as placing it in the 4th month (*op. cit.*, p. 91); Mrs. St. John saw it “at about

cerning the external world could have been made; but the visual interpretation of direction may have been re-enforced by association with sound, from the 4th month on.

Seventh: From the beginning of the 4th month, sounds were probably felt to be external, but could not have been understood as *proceeding from* objects; there may rather have been a passing tendency to *identify them with* the visual object.

None of the auditory associations were very firm, nor was marked interest and attention aroused by auditory experience, except in the case of vocal sounds produced by the baby herself.

When it is considered that all the notes of looking in the direction of a sound earlier than about the end of the third month prove on examination to refer to imperfect and incipient instances of the action, or even to survivals of a mere primitive reflex (p. 31, note 48; p. 123, note 91), and that the late date assigned by Mrs. Hall seems to refer to an advanced stage of the habit, it will be seen that there is a good agreement among the records (Table XI (a) and footnotes). They indicate substantially the following as the *average* course of development:—

TABLE XI (b). TABLE XI (a) CONDENSED AND GENERALIZED.

Age of Child.	Auditory Development.
1st month	Sensibility to auditory jar, non-cochlear hearing.
5th or 6th week	Sensibility to modulated tones, especially musical ones, with full attainment of cochlear hearing.
5th or 6th week (later)	Association of sound with the mother's face, following close on the preceding development.
3d month	Association of sound with visual direction, developing throughout the 4th month.
4th month	Producing sounds voluntarily, by hand and by vocal organs.

16 weeks," Mrs. Daniels at 4 months, Tiedemann at 4 months and 10 days (*op. cit.*, p. 26), Darwin at about 17 weeks (*op. cit.*, p. 33), Mrs. Cook at "nearly 5 months."

"Daniels (girl), 12th week; Mrs. Conard, 13th; Miss Shinn (nephew), 15th; Daniels (boy), at 4 months; Saunders, 23d week.

"McLeish, 9th week; Miss Shinn (nephew), 12th; Mrs. Conard, 16th; Tiedemann, 5th month; Mrs. Daniels, Mrs. Cook and Sully, 6th month.

V. ASSOCIATIONS OF THE MINOR SPECIAL SENSES.

The senses of taste and smell, and the minor dermal senses, need hardly be considered here at all, so little part do they play in the early synthesis of sense-experience by which the external world takes on its main order to the baby's perception. For one thing, the opportunity for their exercise is slight in the early months, and such sensations as they do afford are of a neutral sort. A young infant does not normally experience skin hurts, nor decided heat and cold, nor any tastes except that of milk, and as he is unable to inhale voluntarily, few odors reach the olfactory nerve. Under such conditions, the powerful hedonic impulse is wanting, and associations are slow to form.

1. RECOGNITIONS BY TASTE, SMELL, OR PAIN ASSOCIATIONS.

In the very early association with the nursing position (first month, p. 54, and I, p. 213), the satisfaction of hunger is undoubtedly the determining hedonic element, and the same thing may be true in the recognition of breast, nursing-bottle, etc., about the beginning of the second quarter-year. I noted no instance of the recognition of a visual object by an unmistakable taste association before the 6th month, but no doubt the association can be made earlier, and one good observer has given me an instance occurring in the 3d month.¹⁰⁰

Of any sort of smell association no valid instance is known to me within the first year of life.¹⁰¹

Pain associations seem first to come into play as teachers of caution when locomotion begins,—about the 8th month, in my observations.¹⁰² Incautious movements are quickly associated with resulting bumps. The association of pain with a visual object is rarer.

¹⁰⁰ Mrs. Helliwell of Milwaukee. This early recognition was due to the use of a medicine. Mrs. Tilley's record, like mine, fixes the recognition in the 6th month. In other records I cannot distinguish between the food association and the pure taste association.

¹⁰¹ Mrs. Moore was satisfied that from the end of the 1st month the smell of milk suggested feeding to her child (*op. cit.*, pp. 83-4), but this is uncorroborated, and in direct opposition to Prof. Preyer's observations (*op. cit.*, p. 134). I too found that instead of receiving suggestions of food from the immediate presence of her mother, my niece would as readily stop her cries when lifted to the nursing position on any one else's arm (I, p. 213).

¹⁰² At 9 months, Mrs. Moore; at 10 months, Mrs. Beatty.

2. INTERPRETATIONS.

It is not hard to see how a baby must come to the interpretation of tastes, smells, and the minor dermal sensations that we find in our own consciousness,—that is, to the feeling that they are experienced on our own body surface, but caused from without. But observation adds little to our analytic conclusions about the process.

Tastes cannot fail to be associated early—as early as they attract attention at all—with the well systematized touch perceptions about tongue and lips. As these become localized in consciousness, the taste perceptions must be roughly localized with them, so far, at least, as to be referred to the mouth interior. Almost as early, the sight of bottles, spoons, etc., becomes associated with food, and with tastes as soon as taste becomes an important element in the enjoyment of food. This is certainly by the 6th month, perhaps earlier. By this date, there must be a well established somatic consciousness of the mouth region (p. 137), and some sort of conception of an external object, visible and tangible. The baby may therefore perceive tastes much as we do, as belonging somehow to the external object, but realized in his own mouth.¹⁰⁸

Interpretations of smell sensations must come about in much the same way, but slowly. Far on in the second year, they are referred to the nose with much difficulty, and mainly by means

¹⁰⁸ This analysis can readily be carried further. The taste sensation is always accompanied by contact sensations in the mouth; but the converse is not true, for the baby has immense experience of feeling tasteless objects in his mouth. Hence any tendency to the fusion of the taste and touch sensation into a single consciousness is checked, and we can find but rudimentary instances of it, though such fusion is frequent between taste and smell. Again, the visual-tactile object is so irregularly associated with taste (and never simultaneously) that taste representations are never really *fused* into the conception of an object. Yet in the case of objects that are regularly associated with tastes, the child comes eventually to regard the taste as somehow inherent in the object. So, too, heat and cold come to be felt inherent in the object, though experienced in the body-surface; but pain as only caused by the object. All this is old ground, and is outside the scope of a report from observation. It is only pertinent to point out that these finer distinctions in distributing the reference of experience between the self and the object, must be developed slowly. They may not be complete much before our memory of them begins.

of the acts of holding an odorous object to the nose, and of sniffing (I. p. 176).

There are some indications of difficulty in the reference of pain to the body-surface instead of to the external object, as late as the 11th month (p. 139, note 115); and late in the second year, there is difficulty in localizing them.

VI. FEELING OF A BODILY SELF.

In the preceding chapters I have traced minutely the organization of sense data by which the external world takes on its permanent order in the baby's consciousness. But if it does indeed seem to him an external world, there must be going on at the same time another organization of sense data into another large, complex consciousness,—that of a bodily self; for we cannot conceive a feeling of externality that does not imply the converse feeling of internality.

The sensations on which our own body-feeling rests are experienced from birth (pp. 42-45), and I see no reason to doubt that they begin early to be grouped together and differentiated from the sensations externally referred; but as to the steps of the process I have little to report from observation.¹⁰⁴ In general, it must consist of (1) becoming aware of control over the movements of the body; (2) associating the body-control feeling with equilibrium sensation; (3) differentiating the body-surface from other objects of sight and touch, by its system of double sensations; (4) differentiating the body-interior sensations from those of the special senses, by their lack of systematic intercentral association, through which the experiences of one sense could be verified and measured in terms of another; (5) the integration of all these perceptions into the large and complex consciousness of the somatic self.

1. CONSCIOUSNESS OF MUSCULAR CONTROL.

I am disposed to think this the earliest form in which the feeling of a bodily self dawns on the infant. It is, of course, wholly unreflective, consisting only in an association between

¹⁰⁴ The general discussion of self-consciousness would carry us far beyond the domain of the senses. I cannot wholly omit mention here of the primitive somatic consciousness; but I shall confine myself as closely as possible to its purely sensory aspect.

the feeling of central effort and the perception of the resulting movement. Or, to put it still more primitively, it is an association of those feelings of attention and pleasure that discharge the first voluntary movements with the resultant muscular sensations. This association, we may suppose, begins with the first voluntary direction of the eye to a marginal image, and becomes fixed as the habit of voluntary movement grows. By the time that voluntary movement is initiated with visible *effort* (as when my niece at three months old tried hard to sit up), the central factor in the association must have become quite distinct in consciousness; and by the time that movements are experimented in and watched (as when other babies, at three and four months old, turned the hand this way and that, watching it move), the whole association must be strong, and the child must have a clear (though unreflective) feeling of his own muscular control.

We may safely suppose, too, that this muscular-control consciousness will extend over the body step by step, following upon the appearance of voluntary movement in any part. The dates at which control over the bodily movements appeared, in all observations available to me, are given in the following table.¹⁰⁵

¹⁰⁵ In studying the records of others, I cannot always tell whether the movement recorded was voluntary or not; nor whether it was the beginning of the development, or an advanced stage. I have therefore been obliged to omit a number of comparative instances that I should have liked to use, had they been definite enough.

Where a double date is given in Table XII, the second is that of fairly complete control over the muscles. All other dates are those of the first recorded sign of control.

¹⁰⁶ Preyer himself sets the first voluntary control of the neck muscles (holding up the head) in the 11th week; but he saw intelligent direction of the eyes, and turning of the head to aid the look, as early as the 4th. It is perhaps impossible to say at what stage a movement like this is to be called strictly "voluntary"; but it is enough for the present purpose that the action should be performed with such intelligence and attention as to fix an association between the central impulse and the resultant movement feelings.

¹⁰⁷ I take no account in this table of the control of tongue and lips for purposes of enunciation (16th week to 3d year, or even later). The earlier and easier use of them for active touch and grasping was sufficient to develop the consciousness of muscular control over them. It began probably,

TABLE XII. VOLUNTARY MUSCULAR CONTROL.

Control Attained Over	Date.	Observer.
Eye muscles	3d-5th week	Moore
	3d-8th week	Shinn (boy)
	4th-7th week	Hall
	4th-9th week	Preyer, Shinn (girl)
	4th week	Conard
	5th-7th week	McLeish
	5th-8th week	Tilley
	5th week on	Sigismund (girl), Beatty
	7th-10th week	Sigismund (boy)
Neck muscles	3d-10th week	Shinn (girl)
	3d-25th week	Moore (girl)
	4th week	Preyer, Conard ¹⁰⁰
	4th-16th week	Shinn (boy)
	6th-17th week	Moore (boy)
Tongue and lips ¹⁰¹	7th week	Shinn (girl), Tilley
	8th week	Shinn (boy)
Arms	5th week	Moore (girl)
	6th week	Moore (boy)
	7th-10th week	McLeish
	8th-20th week	Hall
	9th-20th week	Shinn (girl)
	11th week	Sully, Shinn (boy)
	13th-22d week	Tilley
Trunk ¹⁰²	8th week	Shinn (boy)
	9th week	Shinn (girl)
	10th week	Hall
	11th week	Sully
	12th week	Moore (girl), McLeish
	14th week	Moore (boy)
	15th week	Tilley
Hands	8th week	Tilley
	10th week	Moore, McLeish
	11th week	Shinn (boy)
	12th week	Shinn (girl)
	13th week	Hall ¹⁰³
Legs	10th week	Hall
	11th week	Shinn (boy)
	13th week	Shinn (girl), Conard
	15th week	Tilley
	16th week	Moore

in my niece's case, in the 4th week, but was not noted till the 7th (pp. 78-80); it was practically complete within the 2d month.

¹⁰⁰ It is especially hard to know how early movements of turning over or of stiffening and raising the trunk are voluntary; for such movements (like those of lifting the head) are certainly sometimes made by young infants spontaneously, at moments of high general innervation. The instance used in the table from Mrs. Hall's record (*op. cit.*, p. 401) seems to me doubtful; on the other hand, I have passed over instances that *may* have been voluntary, in Mrs. Tilley's and Mrs. Moore's records, as early as the 7th week.

¹⁰¹ Apparently not quite the earliest appearance of control (*op. cit.*, p. 396).

It may be safely concluded from this table that an infant will have a certain consciousness of control over eyes, neck, tongue, and lips, before the end of the second month; of the arms, hands, and usually of the trunk by the end of the third; and of the legs perhaps early in the fourth,—allowing in each case a little time after the incipency of voluntary control, for the development of a sort of habitual control-feeling.

2. EQUILIBRIUM FEELINGS.

The infant experiences equilibrium sensations from the first days of life (p. 42). With the beginning of voluntary efforts to balance the head (3d or 4th weeks, Table XII), these sensations must come into association with feelings of muscular control over the neck, and must take into themselves something of whatever quality of self-reference these feelings have. With efforts to straighten the back, and to sit up (3d month), they are again associated with the control-feelings of the trunk muscles. In the second half-year, when the movements of balance and locomotion are diligently acquired, the equilibrium feelings and control-feelings all over the body must be very closely associated.

3. EXPLORATION OF THE BODY-SURFACE.

From the first there is a great deal of unintentional exploration of some parts of the body-surface. The tongue moves over the inner mouth surfaces and the lips; the lips are in constant contact with each other; the hands clasp down on themselves, encounter each other, move across the face, and are laid hold on by the mouth,—and double sensations are regularly given by these contacts. In this way, even before any attentive exploration has begun, the infant's perceptions of his own mouth, face, hands (and to a less extent of all parts of his body that are often touched by his hands, and of his feet and legs as they touch each other), are differentiated in quality from those given by other surfaces. But attentive exploration soon begins. As early as the seventh week I saw my niece repeating, with evident attention, the movement of the tongue across the lips; and it is likely that some apperceptive attention is given as early

as this, also, to the touch feelings when the fingers are sucked. The muscular-control consciousness of the mouth, which is well established by the end of the second month, is thus re-enforced about the same time by tactile consciousness. And throughout the whole process of learning to carry the hand to the mouth, or to grasp it with the mouth by reaching with the head, strong associations, emphasized by a decided hedonic element, must be consolidated between the feeling of muscular control over hand, arm, neck, and mouth, and the double sensations of touch constantly received; while a systematic differentiation takes place between these double sensations and the very different sort of feeling experienced when an alien object is grasped and sucked.

As soon as the baby begins to watch his own hand while he feels it moving about or grasping, another type of double perception is experienced,—tactile-motor and visual (fourth month, see Table X (b), p. 118); and this still further differentiates his hands from those external objects of sight which cannot be at once seen in action and felt to act. As the co-operation of hand and eye increase, and exploration by the joint use of three departments of sense becomes habitual, the whole body surface is little by little investigated, and annexed to the domain of the somatic consciousness.¹¹⁰

The process is slow, however. It lasted in my niece's case certainly throughout the first year,¹¹¹ and even in the second

¹¹⁰ As to the establishment of the whole system of "local sign" over the body by this co-operation of visual and tactile-motor observation, see Wundt, *Human and Animal Psychology*, Lecture X.

¹¹¹ 19th and 20th weeks.—Marked curiosity about a touch on the back of her head; constant effort to see what touched her.

20th–22d weeks.—Reached for her toes and played with them, feeling over her leg also.

22d–24th weeks.—Carried the toe to the mouth; an action requiring much co-operation of different muscles, and giving a greatly extended knowledge of her own body.

23d week.—Felt over the side and back of her head.

26th and 27th weeks.—Investigated ear, cheek, and side of the head constantly with the hand; also felt over the lips and gums with her fingers.

30th week.—Rubbed the forefinger investigatively with the thumb.

32d week.—Hair was discovered, felt over and pulled with much curiosity.

year there was evidence of very imperfect local sign.¹¹³ In its early stages, about the time that the child is acquiring the power of grasping, there is evidently great ignorance of his own body, and real confusion between it and alien objects of sense. During the period of tactile-motor grasping, my niece's hands, if they chanced to encounter each other, would each seize the other and try to carry it to the mouth; and rattle or fingers were constantly withdrawn unexpectedly from the mouth by attempts to flourish the arms.¹¹³ With the coalescence of visual-motor and tactile-motor observation of the hand movements, this confusion passed away, and there seemed to be a fair self-consciousness, so far as hands and face were concerned. How it could have extended much beyond hands and face in the fifth month, I cannot see. In the sixth month, when the baby began to play with her toes, and even to perform the highly co-ordinated movements necessary to get them into her mouth and hold them there (I, pp. 317, 320-321), her knowledge and consciousness of her own body must have expanded immensely. This amusing movement, which it is hard to regard with scientific seriousness, is really of great importance to the psychic development. It seems to occur pretty regularly,¹¹⁴ always in the early period of joint hand and eye investigation, about the sixth month.

34th week.—A habit for days of examining the tongue with the fingers.

11th month.—Habit of holding the head between the hands, as if to get impressions of its size and shape.

These investigations of head, neck, hair, and ear continued to the end of the first year. In the second year, experiments in pain were made on herself and others, giving valuable material for differentiation between the self and the alien body (14th-19th months).

See I, pp. 142-3, 317-8, 320-1, 152-3. Also *op. cit.*, Preyer, pp. 189-191; Mrs. Hall, pp. 530-1, 534; and MSS. of Mrs. Sharp, Mrs. Catterall, Mrs. St. John, Mrs. Tilley.

¹¹³ A note of the third half-year says, "As a rule she could at this time remember being hurt, but not the place where she hurt herself," and gives several instances (I, p. 152).

¹¹⁴ See also the citation from Mrs. Hall's notes, p. 103, note 73; and Preyer, *op. cit.*, p. 189. I noted many such confusions in my nephew's early grasping.

¹¹⁵ Mrs. Hoyt saw it in the 5th month, and a few notes from the Hon. S. M. Franklin, of Tucson, Arizona, record that his daughter achieved it at the same age; Mrs. Tilley saw it before the end of the 5th month; Mrs. Wood

It is somewhat startling to realize that the baby's somatic self-consciousness can be so limited, at a time when his consciousness of the external world seems to be much the same as ours, to touch and sight. But a good somatic consciousness of mouth and hands alone is quite as capable of giving the contrast between self and not-self as a complete knowledge of one's own body would be. It is probable, however, that at this time—about the end of the first half-year—there is still a large part of the baby's sense experience that is not differentiated in his consciousness as external or internal, nor in any way localized. All the organic and general sensations may belong to this category.¹¹⁸

4. ORGANIC AND GENERAL SENSATIONS.

Sensations of this class enter early into loose associative connection with other sensations, so that the pleasures of food, or of the bath, can be suggested by the nursing position (1st month), the breast or nursing bottle (4th month), the preparations for the tub (2d month, Mrs. Tilley). But they are quite without those systematic associations, growing to fusions, by which we focus diverse senses on one object, and seem thereby to get our belief in its externality and reality. This difference between the two groups of sensations must begin to exist in consciousness from the time the system of intercentral associations begins in visual-motor perception,—that is, from the first active looking, late in the first month. But this alone could not give the organic

and Mrs. Helliwell in the 6th month, Mrs. Conard in the 27th week, Preyer in the 32d, Mrs. Hall in the 36th. Even if infants do not carry the toes to the mouth, they usually play with them a good deal; see records of Mrs. Moore, Mrs. Daniels, Mrs. Catterall.

¹¹⁸ It is possible that even pain is late in clear reference to the bodily self. Mrs. Beatty's boy, at 10 months old, crying vigorously over a bump, called attention to it by pointing his finger at the wall where he had struck his head, not at the injured spot. This was very early in the process of acquiring the balance movements (I, p. 411); as this process goes on, the reference of pain to the body-surface may be coming about. Certainly the succession of muscular efforts, balancings, falls, and bumps, ought to bring pain experiences into pretty close relations with feelings of body-control and of equilibrium. But I have already mentioned the difficulty my niece found in localizing hurts as late as the second year, and of her curiosity in experimenting with pain, and comparing the effect of injuries on her own skin and on that of others (I, pp. 152-3).

sensations their distinct self-feeling, as we experience it. It is more likely that it leaves them as I have conjectured above, quite unlocalized and unreferred. To be self-referred, they must not only be differentiated from the perceptions of the external world, but integrated with those of the somatic self, already gathering about the consciousness of muscular control and of the skin-surface.

I can offer no evidence as to how this comes about. No doubt the process is aided by the acquirement of balance and locomotion; for the observed movements of the body, and the equilibrium and control feelings in standing and walking, could not but connect themselves in consciousness with the alterations they produce in feelings of visceral weight and of circulatory conditions. Probably the integration of all the feelings that go to make up the body-consciousness is slow, and hunger, suffocation, etc., may not be distinctly referred to the body-interior till reflective consciousness has arisen.¹¹⁶

VII. TABLE AND RECAPITULATION.

By omitting from consideration the minor departments of sense, it will be possible to present in a fairly clear tabulated form the synthetic development traced in the preceding chapters. In this table I have generalized the chronology of development, so as to conform it not to my own record alone, but to that of all the records I have examined, as in Tables VIII(c), IX(b), X(b). I have introduced my interpretations of the stages of development, but these are distinguished from the pure facts of observation by printing the latter in heavy-face type.

The tabulation becomes fairly complete by the addition to it of the association of sensations of taste (beginning about the third month), smell (second year), and heat and cold, with ob-

¹¹⁶ In using sign language, in the second year, babies always indicate the mouth, I think, not the stomach region, to express hunger. My niece at 18 months old seemed hardly to understand the word "eat" as distinguished from putting into the mouth, and even confused it with "kiss" (I, p. 226). A few weeks later (81st week) she located nausea, or else the muscular sensation of vomiting, correctly enough (I, p. 235). Up to the end of the 3d year, she did not use words of organic sensation intelligently.

TABLE XIII. ORGANIZATION OF SENSE DATA—GENERALIZED SUMMARY.

Perceptions of the External World.			Perceptions of the Somatic Self.
Sight.	Touch.	Hearing.	
1st Week.—Passive Sensations of Automatic Movement and of			
Light.	Contact.	Auditory Jar.	Equilibrium and Organic Conditions.
2d and 3d Weeks.—Automatic hedonic control of eye.—Fixed gazing at light.			
4th or 5th Week.—Light sensations and eye movement sensations associated; movements suggested by visual stimulus.—Active looking.	Observations wanting—probably automatic hedonic control of lips and tongue.		Feeling of control over eyes and neck. Neck-control associated with equilibrium sensations.—Head balanced.
Sensations take on character of perceptions.	6th to 9th Weeks.—Contact and motor sensations of tongue associated.—Active touch.	5th or 6th Week.—Cochlear hearing established.	
	Sensations take on character of perceptions.	Sound and sight associated. (p. 120)	
		Sensations take on character of perceptions.	Feeling of control over tongue and lips. Touch differentiation of face and hand surfaces from alien surfaces.
8th to 9th Weeks.—Visual and motor sensations of accommodation associated.—Voluntary adjustment to distance.	Automatic hedonic control of fingers. (p. 81.)		
	8th to 10th Weeks.—(Roughly, 3d month.) System of associations between touch and motor sensations of arm, hand, mouth and neck.—Voluntary tactile-motor grasping, and carrying objects to the mouth.	Association of sound with visual direction.—Looking for the "source" of sounds.	Feeling of control over arms and hands. Feeling of control over trunk, associated with equilibrium sensations.
Practice in directing eyes, and in accommodation.	4th Month.	4th Month.	4th Month.
12th to 17th Weeks.—(Roughly, 4th month.) Active visual exploration.	Active investigation with mouth.	Association of sound with sound-making movements.—Sounds produced voluntarily, by hand and voice.	Feeling of control over legs. Visual aspect of hands associated with feelings of control, and of touch.—Hands watched while moving and grasping.
Objects delimited by the eye—plane form perceived.			
Rudimentary interpretations of distance and direction.			
Incipient fusion of visual-motor and tactile-motor perceptions of hands and hand-movements.—hands watched while moving and grasping; for object of sight and object of touch slowly identified.			
5th Month.			
Visually guided grasping acquired; object of sight and object of touch completely identified.			Good somatic consciousness of hands and face.
19th Week.—Visual identification of objects as such.			
	21st Week.—Hand investigation begins.		
Joint hand and eye investigations. Perceptions of form, direction, distance, objective identity, all begin to take on their permanent character.			
6th Month.			
Investigations actively continued.			Good somatic consciousness of legs and feet. (p. 138.)

jects; of pain sensations with the body-surface (beginning, perhaps, in the second half-year); and of organic sensations with the body-interior.

In examining this table, one thing becomes strikingly evident. The sensations of muscular movement are not tabulated in any column by themselves; but all the developments in other departments of sense are woven in upon this pervasive movement feeling, as on the very warp of consciousness. By association and fusion with this, light sensations have become vision, contact sensations true touch. Sound acquires its location in space and its external reference by association, not with mere light sensations, but with the complex visual-motor perceptions; and the whole power to produce sounds at will rests upon their association with movement-feelings. The somatic consciousness seems to be built up by drawing the sight and touch aspects of the bodily self, the sensations of equilibrium, and finally the organic sensations, into a well-integrated association group around the feeling of muscular control. This feeling itself seems to be a fusion of pure muscular sensation with some central consciousness, probably of a representative nature; so that in the last analysis, it is with this central consciousness that the divergence of inner and outer in the reference of perceptions begins. But this last analysis takes us far into the region of introspective psychology, if not close to the verge of metaphysics.

To recapitulate, then:—

First Week.—The new-born baby lies dimly conscious of isolated sensations of light, of contact, now and then of auditory jar, and of the sensations of his own involuntary movements.

First Quarter-Year.—The light sensations, and the sensations of sucking, have a decided pleasure tone, and this intensifies the central metabolism, and so tends to maintain the motor discharge along the same channels. In this way there comes about an automatic maintenance, and later an automatic repetition, of the pleasure-giving movements: the eyes are held by lights, and recur to familiar bright spots; the fingers are kept in the mouth and sucked, or revert thither when removed.

Meanwhile, the tension thus set up at one and the same time in different centers tends to hasten the medullation of their inter-connecting neurons. Associative connections are formed, by means of which the stimulation of visual or tactile center discharges the movement that will give the associated motor sensations,—the glimpse of a bright tract comes to suggest the movements of direction and accommodation that will bring it to the point of best vision; touches on lips or hands suggest the movements of mouth, head, and hands that bring about the mouth-pleasures. Next, the representation of eye-pleasure and mouth-pleasure becomes sufficient to suggest the movements that obtain them, and objects are *sought* by the eyes and the mouth. Sounds, too, come to suggest a visual accompaniment, which the eyes seek to fixate.

Meanwhile, the infant's feeling of control over his own eyes, mouth, and neck, arms and hands, the equilibrium sensations associated with these control feelings in balancing the head, and the difference in touch feelings between his own skin-surface and foreign bodies, must have shadowed out some differentiation between external world and bodily self.

At the end of the first quarter-year, then, the infant uses his eyes well, looks about actively, and though for lack of practice and interpretation he sees objects only as undefined light and dark tracts, he locates these well in visual space. He can use hand or head movements to obtain mouth-pleasures. He associates sounds with sights, and has some perception of their direction. In some rudimentary way these experiences are felt as external, and the body-feelings, at least about the face and hands, as internal.

Second Quarter-Year.—Entering the second quarter-year, the baby rejoices in exploring with his eyes the chiaroscuro spread before him, and presently learns to trace out the outlines of objects in it, to form ideas of their distance and direction, and to identify them in their different aspects. Among other things, he observes his own hands and their movements, especially when they are laying hold of objects. The visual and tactile-motor perceptions thus slowly coalesce, the object is fixated by the eye

and reached for by the hand, is perceived as both visible and tangible.

Meanwhile, sounds and sound-making movements have become associated, and the infant produces sounds at will by hand-movements and vocal exercise.

With the increased power of investigation, he examines his own body-surface, plays with his feet, and co-ordinates the movements of arms, hands, trunk, and legs. In learning to hold the body erect in sitting, equilibrium feelings enter into the same complex with the muscular-control feelings of the trunk. The somatic consciousness is greatly extended and integrated.

At half a year old, the infant has fairly come to the use of his senses, and they give him in rough outline the same phenomenal world as ours. The bodily self from which he looks out on it is not yet explored and well defined in periphery, and the bodily consciousness is of the most unreflective, "animal" sort. The form, dimensions, and properties of external objects are scarcely known. A considerable residuum of sensation may still be felt in primitive fashion, as neither external nor internal. Nevertheless, there is a bodily self, in an external world, where visible and tangible objects are located in space of three dimensions. The whole sense apparatus (excepting that of smell) is under active mastery, and the infant has entered on a vigorous use of it to explore the world of phenomena. From this time his sense-development consists in a growing delicacy and discrimination in perceptions, and in more and more advanced interpretations and inferences.

Such a genetic process as I have inferred in all that precedes is wholly foreign to the conception that has had wide currency through Prof. James's vivid phrase and eminent authority. I cannot think that any new-born child except Minerva, full-armed from the brain of Jove, ever sprang into the midst of "a big, blooming, buzzing confusion." No other had the visual equipment for seeing it bloom, the auditory equipment for hearing it buzz, nor the associative equipment for becoming aware of confusion. Rather does the babe drift softly in among phenom-

ena, wrapped away from their impact in a dim cloud of unconsciousness, through which but the simplest and faintest gleams and echoes make their way to him. Then month after month the multiplex vision without clears itself from the background of cloud, bit by bit, everything grouped and ordered for him in the very process of coming to his consciousness—a wonder and a joy to him, and the most beautiful of all unfoldings to see.

PART III. DEVELOPMENT IN DISCRIMINATION AND INTERPRETATION.

The infant at six months old has passed fairly out of the first period of sense development. He has integrated the elementary sensory reports of phenomena and has entered upon an exploration of the world with a good co-operation of senses. But he is still far from perceiving that world as we do. The sense organs and centers are deficient in keenness and quickness of response, and the interpretation of experience by memory, comparison, discrimination, and inference, has scarcely begun.

My observations on these further processes of development (up to the close of the third year) are summarized in the following chapters and collated with those of others. It is most convenient to group the results under the different sense categories; but of course they cannot be segregated with accuracy. Developments must be classed under Sight, for instance, which were really complex products of several departments of sense and of intelligence; and so with each of the categories.

I. SIGHT.

1. CLEARNESS OF DEFINITION.

The optic nerve, according to Flechsig,¹ begins to develop from its central fibres outward, but at the time of birth is already medullated across its whole section. Whether the retina is in an equally functional condition at this time, and capable of forming a sharp image, we have not (so far as I know) any anatomical knowledge. In any case, whatever the retinal reaction, a clearly defined image in consciousness is impossible until the infant is able to fixate it, and to trace its outlines with the fovea. I have already given my reasons for thinking that this happens about the fourth month (p. 69, *et seq.*).

This stage once attained, the behavior of the child indicates

¹ Gehirn und Seele, p. 53.

an increasing exactness in the definition of images. The rapid growth of recognition shows that objects of vision are becoming differentiated and discriminated. There is a progressive decrease in the *size* of objects that are attended to. Up to the latter part of the fifth month, no object under an inch diameter was noticed and reached for by my niece; in the sixth month, flies on the pane; and in the ninth, as she crept about, every scrap and shred, down to a pinhead size; once a single hair.²

A still better test of fine definition is the recognition of small pictures of known objects, and of printed letters, which was surprisingly good in the 12th and 13th months, the simplest form, the letter o, being spontaneously sought out and recognized down to lower-case bourgeois size (o), in the midst of context (see under Form, pp. 172-3, below; also I, pp. 58 and 73-4). In the 14th month, faces down to one-fourth of an inch in diameter were recognized in photographs, which must have involved some discrimination of minute differences of feature.³

In the early months of the second year, then, the child's eye is scarcely inferior to that of the adult in the power of refined definition; and the mind is capable of making fine discriminations and recognitions on the basis of minute visual differences.⁴

2. PROMPTNESS OF DIRECTION AND ACCOMMODATION.

The first voluntary movements of the eye are noticeably slow. In testing the ability to follow a moving object, one must draw

² Mrs. McLeish notes that her daughter, when first creeping, 10th and 11th months, picked up the most minute objects. Mrs. Hall's boy in the 9th month, Preyer's in the 11th, was absorbed in examining a single hair.

³ Professor Sully, citing this, says that he noticed the same fineness of perception in his boy. Mrs. Daniels's daughter recognized photographs in the 15th month, Mrs. Wood's boy at 16 months. Professor Preyer did not note recognition of photographs and other pictures till the beginning of the third year, but I feel sure this must have been for lack of earlier tests. See also the citations from Mrs. Tilley, Mrs. Catterall and Mr. Cooley, under the head of Form, pp. 173-4, note 36.

⁴ I suspect that good *illumination* is more necessary to the child's visual definition than to ours. As late as the 20th month, my niece's recognition of persons was decidedly affected in a room somewhat under-lighted (I, p. 16). The same thing has been noticed in color perception (I, p. 46, and Preyer, *op. cit.*, p. 20).

it along at a snail's pace, or the baby's eye loses hold of it. By the 15th week, my niece's eyes followed persons constantly as they moved about at their ordinary pace.⁵ In the 23d week, she began to look after falling objects,⁶ but I do not know how accurately she kept them in focus. In the 24th week, she followed the movements of our hands persistently, especially from plate to mouth, at the table.⁷ In the 7th month she watched the flight of birds.⁸

These observations, with the few from other records given in foot-notes, do not discriminate clearly between advance in quickness of direction and of accommodation; and they give but rough measurement of the actual rate of eye-movement. I know of no attempt to measure the rate accurately, except one observation of Preyer's,—viz., that his son once, in the 15th week, followed the motion of a pendulum making forty complete oscillations to the minute,—a surprisingly quick eye-movement, and out of keeping with the child's own habit.⁹ Darwin says that his baby, in the 8th month, could not follow an object well if it swung "at all rapidly."

3. COLOR VISION.

It may be accepted as a settled fact that the newborn infant sees no color (pp. 23-4). The question of the development of color sensations is a perplexing one. Observers have been occu-

⁵ Mrs. Saunders, 11th week; Mrs. St. John and Miss Shinn (nephew), 12th week; Preyer, 14th week; Mrs. Hall, 15th week; Mrs. Conard, 17th.

⁶ Mrs. Tilley (first boy), 18th week; Miss Shinn (nephew), 22d week; Mrs. Helliwell, 26th week; Mrs. Cook, about 28th week ("6 to 7 months"); Mrs. Catterall, 33d week; Mrs. Tilley (second boy), 35th week; Preyer, 47th week. The movement is important as giving space measurement downward, rather than for practice in quick accommodation.

⁷ Sigismund, 19th week. Mrs. Tilley saw a somewhat similar movement in the 17th week.

⁸ Preyer's son looked after a bird flying by, in the 7th month; my nephew in the 6th.

⁹ Professor Preyer says the movement was executed "with machine-like regularity." It is possible that it was not a voluntary movement, but a sort of survival of the old following reflex, of which indications are to be found in the newborn child (p. 25). Sigismund's son followed a pendulum in the 19th week; nothing is recorded of the rate of vibration or accuracy of following.

pied with the secondary question of the *order of emergence* of well discriminated color perceptions, and not with the preliminary question of the beginning of color vision itself. And again, in such observations as we do have on the subject, scarcely any account has been taken of the difficulty in distinguishing reactions to color from reactions to brightness. Indeed, early observations (including Professor Preyer's) failed to consider seriously even the objective illumination of the colored surface as affecting the reaction.

We have three questions to consider: (1) How long does the newborn condition of color-blindness last? (2) By what steps does the child emerge from it? (3) To what advancement in color perception does he arrive within the time under consideration (the first three years)? And these questions have a certain rough correspondence to three periods of development in the child. The first is that in which we can find no evidence of any recognition or discrimination of colors, and must give our attention to the question whether the child really *sees* them at all, or whether his reactions to colored surfaces are not in fact merely reactions to light. This period lasts for about a year and a quarter. In the second period, which we may look for somewhere toward the middle of the second year, signs of the formation of definite color concepts should become apparent to us, if they exist, through the dawning ability to understand or even to use color names, or through evidence of color associations and recognitions. In the third period, which may begin in the latter part of the second year, and certainly by the third year, the child is found more or less capable of all the color concepts, and the observer has only to ascertain how far the color vision is identical with that of the adult, or how far it still shows significant limitations.

First Period: Light and Color.—From the fourth week, in my niece's case, the eyes began to dwell on colored objects, and from the third month, demonstrations of joy and desire at sight of them were recorded (I, pp. 25-29). Yet the instances were comparatively rare, and usually occurred under such conditions that

the baby's interest might have been due to the reflection of light by the colored surface, or to some strong chiaroscuro produced by its contrast with the background, or to its motion. In the case of yellow flowers (and perhaps of orange ones in a less degree) the cumulative evidence of the child's behavior made it hard to doubt that something about the color itself did consistently attract her; but here we have to consider the great inherent brightness of yellow.

The "warm" or long-wave colors seemed to be preferred always to the short-wave ones,—yellow coming first, next orange and red, then pink, while blue and violet were scarcely noticed, green still less. This order certainly suggests a double standard of preference: first, the degree of inherent brightness; second, the degree of redness. But a surface of cold color in strong objective illumination was always preferred to a surface of warm color less lighted; and in general, white objects, and still more, glittering ones, excited more decided reactions than color. When I attempted some tests, at the end of the sixth month, by dangling colored ribbons before the child, she grasped regularly at the one that received the strongest light from the window; and when we made the objective illumination equal, she turned from one ribbon to the other with equal joy. It is entirely possible that had I made the whole set of them gray, matched to the respective brightness of the colors, I might have had exactly the same reactions.

The observations of others accord very well with my own. It has been customary to fix the appearance of color vision about the end of the third week, on the strength of Professor Preyer's observation of the 23d day (*op. cit.*, p. 6). But the object to which Preyer's child reacted was a rose-colored curtain *brightly lighted by the sun*. We have no evidence that the child would not have shown just as much pleasure over a gray curtain, equally lighted. Professor Preyer himself thought it possible that brightness, not color, was the stimulus. In all the notes before me, I find but a single instance of attention to color within the first half-year where the interest seems at all certain to have been due to chro-

matic perceptions.¹⁰ Notes of attention to colored dresses, ribbons, flowers, etc., occur in most records; but the possible influence of high light, or of sharp contrast of light and dark, is never eliminated. In some cases it is evident that there was such an influence: it is noticeable how often it was a white dressing-sack with red spots, cerise roses on a black hat, a red and blue jumping-jack, a striped ribbon, that attracted attention,—objects that to the color-blind would present strong contrasts of light and dark. Indeed, black and white objects are sometimes expressly mentioned as attracting attention, just as the light and dark contrasting colors do.¹¹

Meanwhile, the notices of joy in *light* are numerous and emphatic. Especially moving and changing lights, such as the reflection of sunlight from a shaken glass of water, the flickering lights and shades of wind-stirred foliage, delight the baby.¹²

¹⁰ Mrs. McLeish's daughter, on the 33d day, was tested with Prang's large color sheets, and gazed intently at the red for over 3 minutes, making movements with her arms; the yellow she had looked at only a second or two, with an expression of surprise. The objective illumination of the color sheets may have accounted for the interest in red; but the *preference* of red over yellow, with its much higher light content, would seem evidence of color seeing if the observation were not so entirely unsupported. Even in the case of this same little girl there was no decisive confirmation of it before the 9th month.

¹¹ When we notice a child's joy over a hedge full of blossom, a cluster of berries, etc., we should take into account the profuse high lights and contrasting shadows of such groups of objects.

¹² There is nothing in which all records agree so decisively as in dwelling on the interest and pleasure derived in the early months from the sight of (a) brightness, or strong chiaroscuro, (b) of moving and vibrating objects, and (c) of the human face. "Things which appeared to give him repeated and endless enjoyment of a quiet sort," reports Sully (*op. cit.*, p. 409), "were the play of sunlight and of shadow on the walls of his room, the reflection of the shooting fire-flame sent back by the window-pane or the glass covering of a picture, the swaying of trees, and the like." So, too, Preyer (*op. cit.*, p. 46): "Such strong impressions of light produced gayety, just as swinging objects did. The 62d day, *e. g.*, the child looked for almost half an hour at a swinging lamp, hanging from the ceiling, with continuous utterances of pleasure. . . . His pleasure manifested itself by movements of the arms, and by sounds such as are made by a child only when he is pleasurably excited; his interest was shown by an unvarying gaze. The day before, the child had looked upon the friendly face of his mother for some minutes, and then given a cry of joy. The face of his

With the second half-year, there is more evidence of real color vision. I find in one case the same observation as my own, of

father, too, became at this time, before the 10th week, an occasion of gayety."—Darwin says that the smiles of his children (7th week) arose chiefly when looking at their mother (*op. cit.*, p. 35).—Mrs. Hall's boy in the 3d week was "more attracted by persons than any other object, probably on account of their motion"; in the 5th week, he watched a swinging ball for a half hour, laughing at intervals as he looked, and his first continued laugh was as he watched this swinging ball, two weeks later. In the 17th week he became restless and fretful when his carriage was turned to face a stone wall, but was happy for an hour when it faced the wind-moved leaves and branches.—Mrs. Moore's child, in the 9th week, liked to watch silent movements of the lips and tongue, in an empty chair rocking, the moving leaves outside the window. In the 10th week, while crying, he was laid upon a sofa, above which a gas jet was burning. The moment he saw the light, his crying ceased, and his whole body began to move in excitement, and the interest and excitement were maintained without interruption for half an hour." In the 12th week, most of his waking minutes were spent in the bassinet on a porch, watching the trees moving in the wind against the sky. Thus occupied, he often lay for an hour, quiet except for the movement that accompanied deep interest. Mrs. McLeish's daughter, in the 9th week, "followed with great interest and apparent pleasure the reflection of the sunlight flashed upon the ceiling from a small mirror; followed it everywhere, even when doing so necessitated her turning her head into most difficult positions, and a week later she was kept quiet in the mornings as she lay on the bed by a reflection of the sunlight on the ceiling; she was interested for a half hour in some kindergarten balls fastened over her head and swinging. By the 11th week, these swinging balls had become a source of great pleasure to her. It seemed to be the motion that interested her."—Mrs. Cooley's MS. record says, "The sight of moving things always interested more than color or brightness. He watched the blowing leaves of the trees as he lay in his hammock, from the 8th week all through the summer. Shadows on the ground were a great joy also."—Sigismund says, "There is nothing that children smile at more regularly and frequently than their reflection, or other human faces."

So I might multiply quotations page after page. The sparkling Christmas tree, gilded picture frames reflecting the light, brass knobs on a bed, polished door panels, the flash of the mother's diamond ring, the dark braid of hair lying on her white gown, the contrasting stripes or figures of her sacque, or of the wall-paper, the older child frolicking close by, the face of friend or stranger,—entry after entry, in all records, is taken up with the pleasure and interest excited by such sights.

"Luminosity, brightness in its higher intensities, whether the bright rays reach the eye directly or are reflected from a lustrous surface, this makes the first gladness of the eye, as it remains a chief source of the gladness of life" (Sully, *op. cit.*, p. 300). The strong stimulus given by light and dark contrast, too, appearing as it does by the 3d, or even the

an interest and desire excited by yellow, too consistent to be set aside;¹² in another, of the same general preference for the long-wave colors that my niece showed;¹³ in the case of at least one child, repeated and distinct choice of red.¹⁴ Yet with

2d week, long before "apperceptive illusion" is to be thought of (I, p. 10; see also *op. cit.*, Alcott, p. 8, and Mrs. Hall, p. 458), must be credited to simple physiological reasons, as maintained by Hering. The stimulating effect of motion would seem to be sufficiently accounted for by the number and rapidity of the discharges in visual cells caused by the movement of the image over different parts of the retina. When brightness and motion are united, as in the flickering lights and shades of blowing foliage, or of the reflected light from moving water, the joy is enhanced. This union of changing high lights with motion, as people nod, smile, speak, and move their eyes, is no doubt the first cause of the fascination of the human face, before the baby has begun to associate it with the voice, and with the sundry ministrations of friends.

"By the 27th week he manifested a decided preference for yellow, stretching out his hands for anything of that color—lemons, oranges, sun-flowers, and even the butter on the table." Mrs. Hall, *op. cit.*, p. 460.

"Mrs. McLeish was satisfied that from the 5th month on her little girl showed consistent preference for red and yellow, with attention also to orange and pink—an exact confirmation of my own conclusions. Mrs. McLeish gives one instance of what seems a clear preference of red over blue, in the 9th month: "Tried to crawl to the red ribbon, and reached out her hands for it. When the positions were reversed, she still showed a preference for red." *Op. cit.*, p. 113.

"Mrs. Tilley, whose record is exceptionally candid and cautious in interpretation, and who takes the consideration of objective illumination more carefully into account than most observers, noticed from the 6th month a marked interest in red objects, which she tested pretty conclusively in the 9th month. Sundry dull-colored objects were strewn on a lounge, and among them a red-lined jacket, and a hat with red velvet trimming. The red objects were at once reached for, one after the other. In several careful little tests during the 9th month, Mrs. Tilley obtained the same result, while the spontaneous instances of striking interest in red continued throughout the following months. In the 14th month, the child repeatedly selected a red ball from among many green ones.

It is true that the differences of inherent brightness were not eliminated in any of Mrs. Tilley's tests. A red-lined jacket among a number of dull-colored garments, if these were of light grey or tan tints, or a red ball among bright green ones, would have stood out to a color-blind person as a distinctly *darker* gray, and even though less attractive in itself, might have been chosen because it drew attention by its singularity. But the objection seems to me pedantic, in view of the number and consistency of the red preferences noted by Mrs. Tilley. It is out of the question that red should have been every time, in a period of months, favored by this or that condition of illumination or contrast.

these exceptions, I find still only the same indecisive notices of color reactions as in the first half-year. Recognitions and discriminations depending on color, such as occur in the second year (p. 161), are conspicuously wanting, although such associations are by this time evident in connection with form, and with sound, touch, and taste. In some cases, indifference to color, or at least, the absence of decisive indications of color sensibility, is expressly mentioned by the observer.¹⁵

Two series of formal experiments concerning the color sense in the second half-year are known to me:^{15a} Professor Baldwin's, and a series made by Mrs. Tyler, of Denver, Colorado, and still unpublished.

Professor Baldwin's included 217 separate tests, in which four colors, red, blue, green and brown were used, besides white, and

On the other hand, a single instance of apparent discrimination between green and blue given by Mrs. Tilley (8th month) may very likely have been mere brightness discrimination. The child showed that he recognized a green waist as novel, after he had been accustomed to seeing his mother in a blue one. The colors, fairly alike in saturation (as Mrs. Tilley carefully notes), would differ enough in their place in the "black-white" series to give the child a certain feeling of change; a child's eye is quick for alterations in his mother's apparel, and just the same reaction might have been seen had a darker gray waist been exchanged for a lighter gray.

¹⁵ So Mrs. Daniels, in the case of her son. Mrs. Moore says that her son "did not give conclusive proof of the ability to recognize colors" till the second year. Mr. Cooley says of his child: "Color, as such, seemed not to attract him at all. The brightest reds and yellows had no perceptible effect on him, unless the object moved. Then he showed vague signs of excitement; but this was as great with a white or gray object as with a bright one. When he began to use his hands, accident, or proximity, or some movement, seemed the determining factor in every choice. When he understood speech, red, blue, etc., always seemed at first to mean to him shape, size, or some such peculiarity. That is, when shown a red block, and asked to give a red block, he would choose one of the same kind, but of any color, and when this was rejected, seemed utterly at a loss. We really were inclined to suspect color-blindness." Yet this child showed excellent color discrimination by 3 years old. My nephew, now 9 months old, has always shown the same indifference to color.

With the exception of Mrs. Daniels's and Mrs. McLeish's daughters, every child reported to me (and I have asked the question in many cases outside of the score of records in my hands) has liked uncolored pictures quite as well as colored, or even better, in the first and second years.

^{15a} Besides a series now in progress, with my nephew.

an ordinary newspaper ("chosen as a relatively neutral object, which would have no color value, and no association to the infant"). Neither orange, yellow, nor gray was used, and the question of inherent brightness was not taken into account at all. The tests began at 9 months old, and extended over six months. Of the 217 separate tests, 106 were given with the newspaper, 100 with the colors, and 11 with white. The tests with each individual color were too few to bring out any decided result as to the infant's color preferences. But two results do stand out very clearly: although the conditions of the experiment discriminated against white, and against the newspaper surface,¹⁶

¹⁶ Professor Baldwin's are the first systematic tests (and so far the only published ones) to ascertain the real state of color seeing before the age of speech; and they point out conclusively the general method that all observers must use, to get any further light on the problem. These facts, and the eminent rank of the observer as a psychologist, have given them great weight in all discussions of the subject. Therefore I cannot pass them by in my own discussion without explaining why I am able to utilize them so slightly.

In the first place, where the very point at issue is to ascertain whether the child reacts to brightness or to color, any experiment is vitiated from the outset which fails to consider the question of inherent brightness. Where colors of standard saturation are not used, they might easily exchange places in the brightness scale, and yet seem on casual selection to be of "about equal objective intensity," and "relatively evident spectral purity." Green can take in a good deal of gray before it seems to have lost its purity; blue a good deal of green. I cannot help thinking that the red of any ordinary commercial blotting paper would be deficient in the purity and intensity of the reds that do attract babies at this early stage. It is evident in Mrs. Tyler's experiments that a defect in the purity and saturation of the yellow used was enough to throw it back from a high place in the baby's choice to the very lowest. If colors are not seen at all at this stage, or if they are seen as if in very weak solutions, it is evident that Professor Baldwin may have spoiled his experiment completely for the relative values of red and blue by using a dull red; blue may have been reached for merely as a medium gray, valued as much as the dull red. Mrs. Tyler's experiments showed that a medium gray ranked well with most of the colors in attractiveness. Again, the omission of yellow, orange, pink, and gray from the tests crippled them on precisely the points where we wish information; while "brown" is really a valueless color in such an experiment unless we know the composition of the brown,—the name is the loosest in our color vocabulary.

In the second place, so small a number of trials with each individual color cannot establish any real order of preference, unless the child's choices varied strikingly and consistently. Even if Professor Baldwin's blue and

the newspaper was grasped at in 76 per cent. of the tests, the colors in but 71 per cent.; while the percentage for white, 78, was as high as that for the highest color. With a rectification of the conditions, the superior attractiveness of the white surface, and of the black and white of the newspaper, over any color, becomes quite striking.¹⁶

In 1901, Mrs. Emma Teller Tyler (B. S., Wellesley, '89), repeated Baldwin's tests, using, however, the six spectrum colors, matched to those of Bradley's charts, besides black, white, brown, and three grays. The material was grosgrain ribbon, the lusterless side being used. In a supplementary series of experiments, small balls, in knitted covers, were used. The two series, beginning when the baby was nine months old, extended over a period of about four and a half months, and included 518 single

red had certainly occupied their true relative places in the brightness scale, it would be absurd to set it down as an ascertained datum for color discussion that his child preferred blue, when the difference between her red and blue choices netted just about one more grasp at the blue than at the red, in a period of six months!—and when neither red nor blue was to any appreciable extent more attractive than an old newspaper, at that.

Again, Professor Baldwin assumes that the *distance* at which the child will reach for an object will be the measure of its attractiveness, and this again of the intensity of the sensation, without taking it into account that the surfaces suffer unequally by increase of distance (especially if projected against a background which affects them)—an influence which plainly did come into play. Still again, he has failed to notice that his dice were in one respect actually loaded in the interest of the colors, and of blue especially, as against the newspaper, and the white paper. About one fourth of the total number of tests with these latter papers were made at the difficult reaching distance of 15 inches (a distance at which the child refused to try at all, nine times out of ten); while only about one sixth of those with red, and not as many as one seventh of those with blue, were made at this distance. And conversely, one sixth of all the blue tests and one ninth of the red ones, were made at the short distances at which grasping was invariable—and *not one* of those with the white paper, or the newspaper! Total percentages based upon such inequities are valueless. By eliminating the extreme columns, where the inequities occur, one may see from Professor Baldwin's data that the white blotting paper and the old newspaper were decidedly more attractive than any color (were, in fact, grasped all but invariably); that the difference between red and blue was inappreciable (about a quarter of a grasp, in six months); and that brown and green were really discriminated against, but how much we can scarcely say, in so small a number of tests.

experiments; but as Mrs. Tyler used a larger number of colors than Baldwin, her percentages for each color are not based on figures so much larger than his as might appear (Baldwin, 11 to 35 tests to a color; Mrs. Tyler, 17 to 80). All conditions of objective illumination, of fatigue or variation of physical condition in the subject, of the influence of preference for right or left hand, of reaching distance, etc., are carefully attended to and recorded. The tests were divided between the strict Baldwin method of offering the colors singly, and recording the ratio of "acceptances," and that of offering them in pairs for comparison and choice. Sometimes the balls were placed in a row on the floor, and the child was allowed to creep to them and select. In such cases, the order of arrangement was constantly changed, so as to favor no color by position.

Mrs. Tyler's experiments are the fullest and most careful yet reported.¹⁷ Yet they leave us still without conclusive evidence as to the condition of the color perceptions at a year old. The strongest impression they left in the mind of the observer herself was that of the child's indifference to colors. He reached for them when they were placed before him, but was consistently interested in the apparatus more than in the colors. When only one color was offered at a time, he took each one that was offered till he grew tired, then refused all; when two were offered he sometimes took regularly the one at the right hand, sometimes regularly the one at the left hand (apparently finding no sufficient stimulus in the color to inhibit the momentary habit suggestion); again, he is recorded as seizing both at once. The total percentage of "acceptances" (or more correctly, preferences) of colors was 58; of members of the black-white series as against colors, 65,—an actual superiority in the black-white impressions

¹⁷ There is one possible source of serious error in considering Mrs. Tyler's results. In the pairing of colors, a color might be given an accidental advantage by being paired unduly often with one less attractive than itself, and *vice versa*. Mrs. Tyler's combinations were so many, and so well distributed, that in the cases where forty or fifty tests to a color were made, I think errors of this sort canceled out fairly well; but where the tests were few, it is necessary to go back and study the detailed experiments (which are fully reported) to see whether the ribbon in question had its fair chance and no more.

over the color ones, due to the fact that white was in higher favor than any color, while the grays on the whole stood high. Even black stood about as high in favor as blue, and higher than violet.

In the individual choices, there was little to establish clear color preferences. In the ball experiments, Mrs. Tyler was unable to secure a good yellow, and the one used (weak in saturation, and tending toward green) was rejected by the baby even more decidedly than black, though in the ribbon tests, where a good yellow was used, it was among the favored colors. A deep, reddish brown, (falling between the red and orange in the weak-light spectrum) seemed to be preferred to all other colors in the ribbon tests; but the number of experiments with this color was few (17), and I thought them inconclusive, for the reason mentioned in note 17. If we set them aside, and also those for yellow in which a weak and impure tone was used, we get from the tests the usual net result,—red, yellow, and orange the most favored colors, but neither liked as well as white, nor showing any superiority in attractiveness to mere gray.

One item of significance is that in the ball tests, but not in the ribbon tests, orange attracted the child conspicuously,—the only clear and persistent preference shown in all the tests, surpassing even the preference for white. Mrs. Tyler suggests that association with the fruit (with which he often played) accounts for this discrepancy between the two sets of tests. If so, we have here the single instance of association by color that I can find, earlier than the middle of the second year.

Add to these two formal sets of experiments some informal ones that were tried by Mrs. Sharp with her baby in the seventh month, when he consistently dropped red, blue, or yellow ribbons to grasp at either scarlet or gray, but preferred the scarlet as consistently to the gray,—and we have gathered all the evidence that I know concerning color seeing in the first year, and the earliest months of the second year. Three conclusions from it are irresistible: (1) Color interest is weak, and colored objects are preferred to gray ones in far less degree than is popularly supposed, if at all; (2) Brightness, on the contrary, is always attrac-

tive; (3) Red (including pink), yellow, and orange are overwhelmingly indicated as the colors that attract most.¹⁸

A theory of color vision in the infant formulates itself quite plausibly from these conclusions, as follows: For the first half-year, at least,—perhaps far on into the second half-year, in some cases,—the child receives only light sensations, not chromatic ones. Surfaces, therefore, attract in proportion to their brightness, white first, then yellow. Sometime in the second half-year, sensations of red begin to be received, which contend with those of the primitive black-white scale for the baby's attention, in the order red, orange, pink (pale red). If these red perceptions are very feeble, or even lacking altogether, the baby will seem to prefer yellow, though seeing it, in fact, only as a light gray; if they are better developed, red objects will attract most. At a year old, therefore, the child would see the world in two color series, the black-white series, running through all degrees of gray; and the red series, including all degrees of red.

The theory fits the facts well, except for one consideration; and that is, the uniform indifference to *green*. If yellow is valued for its brightness only, it is not comprehensible why green, so close to yellow in inherent brightness, should fall so decisively below it in attractiveness.^{18a} Professor Kinnaman's monkeys

¹⁸ I do not ignore Professor Baldwin's testimony to blue as a favored color; but I have already given my reasons for thinking it inconclusive, and it stands absolutely alone, as far as this early period is concerned. I do ignore many general statements that this or that was the "favorite color" of some baby. Casual observation is easily misled in such a matter. A baby's interest in an object is often attributed to color, when the exclusion of other interesting traits—form, motion, use—or of direct suggestion, would show that color had nothing to do with it.

^{18a} It is possible that green has not a fair chance in the favor of babies, because the greens used in dress and furniture are never pure, bright greens; while the greens of foliage contain a great deal of gray. Still, Mrs. Tyler's tests with standard colors ranked green decidedly below yellow. See also note 31, p. 169.

It should be added that it is not really established that white, apart from strong objective illumination, is consistently preferred to yellow in the first year. If it should be shown that any baby of this age did in fact prefer yellow to white, we must conclude that it is already valued for its yellowness, not its brightness alone.

could not discern brightness differences as slight as that between yellow and green, when the grays were not re-enforced by color quality.^{18b} We are obliged to think, therefore, that some color is seen in yellow,—probably but a faint infusion, since even in the third year, when all the color concepts are fairly clear, there appears a tendency to confuse yellow with white (p. 168). There is, then, a double standard of preference, but it is not so much a brightness standard and a redness standard, as a brightness standard and a “warmth” standard. That vividness, that “energy of decomposition,” which we ourselves feel in the long-wave colors when we call them “warm,” seems to be that which attracts the infant, and competes with pure light in his preference. All color impressions seem to be feeble at this period, and it is not improbable that something in the impact of the long waves is able to discharge a chemical process that cannot yet be accomplished by the short waves.^{18c} If this is so, then blue, green, and violet are seen only as gray; red, orange, and pink attract by true color quality; and yellow by brightness, enhanced by a faint infusion of color.

Second Period: Dawn of Conscious Color Discrimination.—

In the first quarter of the second year, my niece's behavior toward color was just as in the first year,—the same interest in light and shade, the same comparative indifference, or even defect of perception, toward color. The first evidence of speech carried on the same indication. The child was at the time picking up the meanings of words with rapidity and ease. *Light* and *dark* (as a light or dark room) were readily understood in the 14th month, and before the end of the month the child herself began to use *dark*, applying it, together with *black*, to any ink-blot,

^{18b} Mental Life of Rhesus Monkeys in Captivity. By A. J. Kinnaman. American Journal of Psychology, Vol. XIII, pp. 98-148, 173-218.

^{18c} Preyer's theory of color vision—that it is an exalted development of the heat sense, and develops regularly from sensitiveness to those vibrations that are nearest the heat-wave in rate to those that are furthest—has, I believe, no acceptance whatever with physicists. Romanes, however, approaching it from a biological point of view, thinks it plausible, when we remember that visual sense probably arose by elaboration of temperature nerve endings (Mental Development in Man, pp. 98-103).

smut, dirt-streak, or the like. Color names, on the contrary, she seemed quite unable to understand until late in the 16th month (I, pp. 29-30).¹⁸⁴

At this date, a great change appeared (I, pp. 31-35). She began suddenly to name *red*, exclaiming, and pointing with zeal to red objects. A month later, in another wave of spontaneous interest, she began to name *yellow* and *blue*. The colors were recognized in various degrees of purity and saturation,—a sure evidence that they were distinguished by their chromatic quality. The child also caught readily the meaning of the question, "What color?"—knew, that is, what trait of the object was to be separated out and named. In the following month (18th) I noticed for the first time instances of memory and comparison by means of color.¹⁸⁵ And now appeared, at 18 months old, such interest in colors, such spontaneous exercises in naming them, (as in pulling out books, one after another, calling the colors), and such correctness of perception, that I began formal color tests; with the result that the child proved perfectly able to discriminate and name all the spectrum colors before she was 22 months old (I, pp. 31-32, 34-54).

We seem here to have detected a period in which the child was capable of the concept *black*, but not yet of any color concept, followed by a period in which she was capable of the color concept

¹⁸⁴ My published "Notes," in the pages cited, give the impression that it was quite as impossible for the child to distinguish *white* from any color name as the color names from each other. My more detailed original notes show that this was not quite so; there was a feeble ability to distinguish an object by the description "white," but absolutely none to understand one color name as distinguished from another.

¹⁸⁵ As, for instance, when the child cried, "Lady!" at sight of a piece of red cloth, some weeks after a lady in a red dress had visited the house (I, p. 34). So Mrs. Tilley's boy, at 17 months, cried, "Custard!" at sight of something yellow, and Professor Sully's in the 19th month, "Apple!" at sight of a patch of reddish color (*op. cit.*, p. 422). Such associations, had they existed, could have been expressed in language some months earlier than this; and even before that was possible, the child would have been likely to show them in some way, as he shows easily enough that a black and white outline picture suggests the cat, or the sound "bonnet" the corresponding object. The one hint of any association of the sort that I find earlier than about the beginning of the 18th month, is that indicated by the fondness of Mrs. Tyler's boy for an orange-colored ball (p. 158).

red, but no other, and again by a period in which all the color concepts became possible. If this was a typical case (I have not the comparative data to judge how far it may be so)^{1st} we have in the color concepts of a child at about a year and a half old a striking parallel between ontogeny and phylogeny. There is the same expressed consciousness of black and white, shine and shade, preceding any color words; the same early emergence of red into linguistic consciousness, the same delay in naming other colors.

How are we to interpret this curious succession of stages in color naming? We can hardly doubt that red, orange, and yellow, at least, were *seen* for months before; why is red now discovered, as it were, with sudden interest and pleasure? and thereafter, the other colors? Can we consider the wave of attention and discrimination as due only to the new power to *name* the perceptions?—a power that is always intensely interesting to

^{1st} Mrs. Hall's boy noticed and named *black* from the 13th month, and at the date when the record closes, in the 17th month, had not been able to use any color word intelligently. I find no record except my own of the real use of color names before the 22d month; in some cases a few are included in vocabularies taken at two years old, but the date and order of their appearance is not given. Toward the end of the second year, and in the third, there is reason to think, a child fairly well advanced in speech is capable of understanding and learning almost any color name, and a hundred chances of suggestion may determine which one he will pick up first; so that by this period the order of appearance ceases to give us much clue to the order of emergence of the concepts. For what it is worth, I give the instances of color words used before the end of the second year in which I can determine the order of appearance. Mrs. Moore's son used *red* only, before the third year; one of the children reported by Professor and Mrs. Gale used *pink* (light red) in the 23d month; Mrs. Tilley's older boy used *blue* in the 22d month, and her younger son at the same age mastered *red* and *blue* somewhat imperfectly, by teaching. Of these two brothers, the elder in the 22d month recognized pieces of green and blue cloth as matching well-known garments, and the younger, between the 19th and the 24th months, learned to discriminate most of the colors, somewhat reluctantly. Mrs. Moore's son "showed that he recognized" several colors (21st-23d months), in the order pink, yellow, black, blue, red, light brown and gray; no detail is given of the observation, however; the names were not used, unless *red*. Mrs. Conard's boy, in the 22d month, recognized pieces of green gingham as matching his apron, but did not name colors till the 3d year. It is evident from these instances that there was no constant relation between the order of development in color recognitions and in color naming.

the child, and that leads him often to discriminating observation of things he had scarcely noticed before? It would really beg the question to say so; why should the power to name the perceptions be delayed to this period, when other concepts, which seem to us much more abstract and less obvious, are coming rapidly to expression?

Grant Allen, speaking of the same problem in ethnology, says color names appear late because they are adjectives, and require an advanced mental process in analyzing out the attributes of an object and naming them, apart from the object itself. We must not be pedantic with a baby's parts of speech: it is convenient to speak of them as nouns, and verbs, and adjectives, but we cannot really force them under our grammatical categories. That which interests the baby (whether it be a group of traits fused into a single concept, as *kitty*, or a single striking trait, as *dark*, or *hot*), calls to his lips as a mere ejaculation the articulate sound that has become associated with it.¹⁹ And I cannot see that there would have been any more advanced analysis in pointing at a red ribbon, or blot of red ink, and crying, "Red!" than in pointing at a blot of black ink, or a coal smutch, and crying, "Black!" Yet the *red* identification seemed impossible to my niece for two months after the *black* one was easy; to Mrs. Hall's boy for at least four months. Both these children, moreover, used several other descriptive adjectives before color names appeared; and while no other record corroborates mine as Mrs. Hall's does with regard to the early appearance of *black* (*dark*, however, often appears early), all the vocabularies in my hands show that other adjectives did precede those of color, by a considerable interval,—two or three months, even up to eight months, in all cases where I can fix the dates.²⁰ Color fails some-

¹⁹ Notice, for instance, how often in the baby's "nouns" a single salient trait only is really named; so that "chemin de fer," for instance, means a railway engine, a coffee-pot, anything that hisses and smokes and makes a noise, and "star" anything bright or shining (Sully, *op. cit.*, p. 163).

²⁰ *Op. cit.*, Sully, pp. 427-8, 437; Mrs. Moore, pp. 141-3; Mrs. Hall, pp. 604-6, 461; Dr. Wilhelm Ament, *Entwicklung von Sprechen und Denken beim Kinde* (Leipzig, 1899), pp. 109-117.—M. C. and H. Gale, *The Vocabularies of Three Children of One Family, to Two and a Half*

how to supply a trait salient and interesting enough to call out the earliest adjective-making tendency,—temperature, size, taste, all take precedence, and this even in cases where special effort had been made to call attention to color differences. And the other colors still fail, after red has “risen to verbal consciousness.” The fact that red pushes so far to the front of yellow in nomenclature (both with the child and in philological history) goes to confirm the suspicion that it is chiefly for its light-strength that yellow is valued, and that its chromatic quality, though enhancing the pleasure, is not very clearly felt.

For the short-wave colors, I cannot find conclusive evidence that any baby, up to the 18th month, can even see them. Yet as a matter of fact, whether these colors are or are not seen at all in the first year, I have no doubt that for some time before they are noticed and named there has been some perception of them. The real condition of color vision about the middle of the second year is probably very much that which is formulated by Magnus, in speaking of “*Naturvölker*” whose color-seeing has been well investigated:²¹ “The *range* of color sense is invariably the same. The seven colors are everywhere distinguished”;²² “A

Years of Age (Minneapolis, 1900), pp. 90–91.—MSS. of Mrs. Tilley, Mrs. St. John, Mrs. Hoyt, Mrs. Conard, and of Mrs. Bertha de Laguna Price (B.A., M.A., Stanford, '94, '97). Mrs. Price's older daughter used at least 17 descriptive adjectives intelligently at two years old, but echoed color words without meaning; and Professor and Mrs. Gale report 36 descriptive adjectives in their youngest child's vocabulary, before the first color word. Mrs. Moore says, “Color adjectives were the last to be added” (*op. cit.*, p. 128).

Professor Sully notes, truly enough, that the first adjectives refer “rather to the effect of things on the child's feeling than to their inherent qualities,”—as *hot, cold, wet, pretty, good*, which take precedence in most lists. But there is no lack in most lists of such objective words, also, as *black, big, empty, clean, dead*. And, as I have just remarked, many of a baby's nouns are quite as truly adjectives as a color name would be.

²¹ Ueber Ethnologische Untersuchungen des Farbensinns.

²² Dr. Kinnaman has carried the proof of complete color-seeing even further back, putting it beyond doubt that monkeys can see all the colors well enough when there is anything to be gained by it. Yet there is evidently some difference between the monkey's color-seeing and that of man, for with both his monkeys green was the color most securely identified (*op. cit.*, p. 145).

race may have good color discrimination, and miserable color vocabulary, except for red"; "They have all the color sensations, yet there is a variation in the intensity with which they are felt; some parts of the spectrum are felt strongly, others seem to be felt as alike, or neglected, and these are always the short-wave rays; red, up to yellow, is always strongly felt."

Third Period: Color Development to the End of the Third Year.—From the middle of the second year up to the end of the third falls a period in which careful tests have always found the child able to discriminate all the color impressions, about as well as any grown person. Some children pick up a correct use of color words quite spontaneously at this time, like Binet's older daughter, and Mrs. Tilley's older son; others, like Preyer's son, prove capable of being taught them; in still other cases, as with Mrs. Chapman's and Mrs. Slack's children (I, pp. 51-2), and Mrs. Tilley's younger son, the child refuses to submit to tests, yet the mother satisfies herself from chance indications that the colors are really discriminated.

My niece at this period (under stimulus from color tests) took great delight in observing and recognizing colors—mainly as an intellectual exercise, but with some æsthetic pleasure. The effect in increasing her interest and enjoyment in the visible world about her was notable (I, pp. 34-56, 91-95). But I find marked interest in color at this age reported in but one other case, that of Mrs. Tilley's older boy.

Color tests at this period have always been undertaken with a view to determining the *order of excellence in seeing*, as between the different colors. The number of correct identifications of each color was expected to be in proportion to the distinctness with which it was seen, just as in a color test with an adult. If anyone tries, however, to get quantitative valuations of the color-perceptions from the numerical results of such experiments on a little child, he will be led much astray. In a rough way, the tables yield a great deal of information; but their quantitative accuracy is affected by the following considerations, all due to the limitations of the little subject's ability to conform to the conditions of the experiment:—

(1) When the method of identifying the colors by name is used, confusions in word memory arise. When Binet's "methode de reconnaissance" is used (showing the color, then mixing it with others and telling the child to pick it out) the color must be carried in memory; moreover, to a child in the second year the requirement is harder to comprehend than the simple inquiry, "Where is red? where is blue?" and I did not find the method practicable so early.

(2) Children misname, or select wrongly, out of inattention or whim, and such errors not only lower the total percentage of correct answers, but affect the different colors unequally, for the little ones have likes and dislikes among them that have no connection with clearness of seeing.

(3) The colors first introduced stand at a disadvantage as against those introduced later in the series, after the child has become trained in the experiment. If the color seeing does actually improve during the period, and if the period covered by the experiments is long (it was ten months in the case of Preyer's child), this may be a large source of error.

(4) It is next to impossible to get even an approximately equal number of tests for each color, partly because some are introduced late, and partly because of the child's whims and preferences; one color will be reached for over and over, and spontaneously identified, another the child will refuse to take into consideration at all, though you know him to be perfectly able to see it and name it.

Most of these errors a careful observer should be able to detect, and allow for. A name confusion, especially, he should be able to distinguish from real difficulty in distinguishing the color,—checking the formal tests, as he can, by chance lights, as when Mrs. Tilley's child, who refused tests, recognized bits of cloth promptly as like his brother's blouse, etc. Anyone constantly with the child knows his habitual whims and preferences among the colors, and sometimes their origin. Corrected thus by the observer's opinion, the experiments should give an *approximate* idea of the distinctness with which the respective colors are distinguished, but without any quantitative accuracy.

We have three series of such experiments relating to the period in question, Binet's, Preyer's, and my own, including in all nearly 3,000 single tests.²³ In the following table I summarize the principal results.

TABLE XIV. FORMAL TESTS OF COLOR DISCRIMINATION.²⁴

Experimenter.	Binet.	Preyer.	Shinn.
Method.	{ Naming color. ²⁵ Recognizing color.	Naming color. ²⁶	Naming color. ²⁷
Material.	Holmgren wools.	Magnus tablets.	Prang tablets.
Sex of child.	Girl.	Boy.	Girl.
Age when tests began.	2 years, 8 months.	2 years.	18½ months.
Duration of tests.	6 months.	10 months.	3 months.
Percentage of correct answers.	Not stated. ²⁸	70.8.	92.7.
Apparent order of good discrimination. ²⁹	Red, blue, orange, chestnut, pink, violet, green, yellow.	Yellow, brown, red, violet, pink, orange, gray, green, blue.	Pink, orange, green, yellow, blue, brown, violet, red.
Probable real order, correcting name confusions.	Red, blue, ³⁰ green, orange, yellow, chestnut, pink, violet.	[Green and blue probably would rank higher.]	Red, blue, yellow, orange, green, pink, brown, violet.

²³ I am passing over Dr. Garbini's few tests at this age. I should have to go into a detailed analysis of his tables to explain my inability to use them. But in brief, I find myself unable to deduce from them, in most cases, the same results that he does, and it is quite evident that he is dominated by a theory of color vision, according to which the child should be color-blind up to the middle of the second year; should then enter a period of red-green color-vision, which lasts until the 4th year, when blue and yellow emerge. His table for the second and third year is based on an examination of 8 children, each of whom seems to have been asked once to match each color, and once to name each color. That the children could name and match red best is evident enough; but beyond this his own table seems to me quite unable to support his conclusion in favor of red-green seeing at this period. Two of the eight children were able to match all the colors, and those who could not, gave not the least evidence of seeing green better than blue or yellow. (*Evoluzione del Senso Cromatico nella Infanzia.* Del Dott. Adriano Garbini. Firenze, 1894.)

²⁴ Binet, *Perceptions d'Enfants*, *Revue Philosophique*, Dec. 1890; Preyer, *op. cit.*, pp. 7-22; Shinn, "Notes on the Development of a Child," I, pp. 35-53.

²⁵ Including recognition of the color by name, as well as naming it.

²⁶ All the answers were correct by the "methode de reconnaissance," but the child was already three years old before this was begun. The results used in this table are those of the naming method, checked slightly in the last entry by some momentary errors made in recognition tests.

²⁷ I have omitted black and white from the table. There really is no question of the child's ability to see them. When he confuses some light color with the white, or some dark one with the black, it is his valuation of the color, not of the black-white impression, that is at fault. It is somewhat odd that white, which the baby seems to see sooner and like better than any

In eliminating as far as possible *name confusions* from the foregoing table of results, I have by no means eliminated all the sources of error, as may be seen from the footnote on blue. And even if we could arrive at a correct list of the order in clearness of perception, we must not confuse it with the order in the child's *preference*. A color that is actually disliked may be quite clearly distinguished.

What then do we get from these laborious tests? Three important results. The first is, that they prove beyond question the possibility of a complete perception of all the different color qualities in the third, and even in the second year,—a matter that floated on a sea of conjecture before. In the second place, after making all allowances for errors in the order of correct perception, there is still discernible a firmer vision and more interest toward the red end of the spectrum, and a weakening as violet is approached. And in the third place, when the experimenter's reports are studied in detail, the *types* of error that occurred are illuminating.

On this last point I must dwell. The errors (even slight and momentary ones, showing a *tendency*) that seemed to be due to real difficulty in discrimination, were as follows:—

TABLE XV. SIGNIFICANT COLOR CONFUSIONS.

Experimenter.	Binet.	Preyer.	Shinn.
Confusions observed.	White with pink White with yellow. Green with yellow.*	All very pale colors with white All very dark colors with black. Green with blue.* Green and blue with gray.	White with pink. White with yellow. Violet with blue.

color, should be late in getting securely named. I can only conjecture that white presents itself to the mind in a sense as the norm, from which colors vary, and does not seem to need a name. It is known only by contrasts, and the contrasting surface gets the name.

* Blue seems, in these naming tests, to emerge to a higher place than might be expected, from the absence of any sure evidence that it is perceived in the first year and the early part of the second. There may be some element of suggestion in this: blue is pushed forward by the experimenter, to see if the child can distinguish it from red. Perhaps the child himself feels in it the decided contrast with red which the experimenter feels in pushing it forward, and so distinguishes it more easily. It is well learned before the colors that might be easily confused with it, green and violet, come on the stage.

* These errors persisted as name confusions, but seem to have begun in some real difficulty of discriminating the colors.

These confusions fall under two obvious generalizations:—

1. Feebly saturated colors are sooner confused with white, heavily saturated ones with black, than in adult vision. The chromatic quality disappears sooner at both ends of the scale. It is exactly as if the colors were seen in a feebler objective illumination than with us. And in fact, an actual lowering of the objective illumination seems to destroy or confuse the color to a child, when it is still quite clear to an adult; as when my niece called violet black, and yellow orange in the shadow (21st month, I, p. 46), and Preyer's boy, in the 4th year, saw light blue as gray in the dusk of morning.²⁰

It may be that the chemical reactions of the retina are weaker in the child, and require a stronger light-shock to discharge the color process. But it is also an important consideration that the color-sensitive region of the retina is smaller than with us, so that the child gets the effect of a smaller tract of color, and therefore of a lower saturation.²¹ Professor Luckey says:²² "Representing the average range for the adult eye for the four colors as 100, the average for the thirteen-year-olds would be represented by 77, and the seven-year-olds by 61. . . . Now should we continue still farther backward, and this law hold true, we should finally reach a point in the child's development where the eye ceased to be sensitive to color impressions." At three years old, the color-sensitive region must be so circumscribed as to make an appreciable difference in the color-seeing,—and a difference of just the sort that we find existing.

"It seems probable," Professor Luckey continues, "that the child inherits from past generations an ever increasing color *tendency*, but nothing more; . . . the different color stimuli must play on the retina in order to develop this color tendency into a real mechanism for the discrimination of color." This is strikingly like Dr. Magnus's independent conjecture from the

²⁰ *Op. cit.*, p. 20.

²¹ Professor MacDougall reports experiments showing that red loses least in intensity, green most, by reduction in color-area—a fact which has a bearing on the high value of red and low value of green to the baby.

²² Comparative Observations on the Indirect Color Range. By Geo. W. A. Luckey. *American Journal of Psychology*, Vol. VI, pp. 489–504.

ethnologic point of view. We must not conclude, he says,³³ that the primitive condition was an analogue of color-blindness: actual inability to sense colors did not exist, but a condition like that of the periphery of the retina,—which is as good as incapable of color-seeing, yet by enough strength of stimulus can see them, and by due practice can be cultivated; this is a survival of the earlier condition of the whole retina.

It must be noted, however (and Professor Luckey does not fail to see the difficulty), that if the peripheral condition of the retina is really the analogue of the primitive condition of the whole retina, *blue* should be the color first noticed and first named; while in fact Professor Luckey, like most other observers, "questions whether his own children were able to perceive blue before they were 18 months old, while they knew and seemed to enjoy red, orange, and yellow very much earlier."³⁴

2. There is a tendency to confuse colors next each other in the spectrum, at the short-wave end. Each child shows a trace of this confusion, but each with a different pair of colors. Professor Preyer thinks that green and blue were at first actually seen almost as gray. Considering the remarkably good discrimination of slight differences, all the way to the violet end of the spectrum, which my niece showed by the 22d month (I, pp. 42, 47, 53, 92-3), a better discrimination than she showed several years later, after her attention to colors had lapsed, I find it hard to think that there was any real defect of vision; but rather that the difference between these short-wave colors did not appeal to the children as important, exactly as men of average education constantly call violet "blue,"—not that they are seen as alike, but that the difference does not seem to be worth naming. Even women well trained in color are willing to call both salmon and rose "pink" though one is actually light orange and the other light red. To all of us, also, blue and green approach each other in quality as saturation becomes less, and, as has just been pointed out, the child probably sees all the colors as less saturated.

In this confusion of spectral neighbors, also, the parallelism with primitive races is striking.

³³ *Op. cit.*

³⁴ *Op. cit.*, p. 500.

During this period of a year and a half my niece's preference for the warm colors declined and disappeared, and she took more equal pleasure in all colors (I, pp. 55, 94),—another evidence of full development of the color perceptions. Nevertheless, the contribution of *light* to her enjoyment remained great, and for years a spangled or silver-woven white dress seemed to her (as to other children, so far as I have seen) more beautiful than any color. The distinction between light and dark saturations of the same color she comprehended at a word when 22 months old, and was able at once to generalize it (I, p. 52).

For color harmony, I can find no trace of feeling within the first three years, either in my own record or any other. Indeed, I suspect that it is a late and rare development among adults. Probably color itself, as distinguished from light, is less important to adults than they realize; to most of them the chromatic quality merely enhances the pleasure in brightness. It is easy to overrate the æsthetic feeling for color and for color harmony in civilized society, since people follow each other's lead so much in dress and decoration.

Summary.—The subject is far from being cleared up: but we are at least justified in the following conclusions:—

First, The child is insensitive to color at birth, and may continue so for several months, though here we have only negative evidence.

Second, Feeble color sensations, beginning at the lower end of the spectrum, and developing progressively upward, begin to be felt, certainly within the second half-year, and perhaps earlier. They include all the long-wave color sensations by the end of the first year, and probably the short-wave ones follow soon after, but there is no actual proof of the existence of these before the 18th month.

Third, By the third year, or it may be by the latter part of the second, the child has all the color perceptions of the adult, and can be taught to discriminate and name them quite perfectly, and to notice color in the world about him.

Fourth, Colors are seen by the infant more feebly than by the

adult, as if in a lower illumination. This difference grows progressively less, and has nearly disappeared by the third year. It is probably due, in part at least, to the restricted area of the color-sensitive tract of the retina.

Fifth, Pleasure in light precedes pleasure in color; next, pleasure in colors appears, depending jointly on their light-richness and their "warmth"; but by the third year the warm colors in some cases lose their advantage, and the cold ones may give as much pleasure.

But for color *harmony* no feeling is to be found in the little child.

4. FORM.

The recognition and discrimination of form, so far as it is visual only, has naturally a precedence over that of color, since light and shade alone supply the material for it. The understanding of solid form is of course not visual only, but requires much inference from tactile experience, and is to be classed as an interpretation rather than as a direct perception.

Before the fusion of tactile representations with the visual perceptions, all bodies must have been seen by the infant very much as plane outlines, projected against the background. Not that the characteristic massing of light and shade upon solid bodies could have been neglected in visual discriminations, even before it came to indicate solidity; still, pure outline figure must have made appeal to the infant's attention very early, or it could not be so remarkably well discriminated as it is before the end of the first year.

My niece first showed noteworthy interest in the visual aspect of objects in the fourth month (p. 71). Recognition of objects by sight rapidly followed, as has already been related, and in the eleventh month, outline pictures began to suggest the object (I, p. 72). From the beginning of the 12th month, she proved able to distinguish with nicety small outline forms, as the letters of the alphabet,—at first perhaps an inch in size, on blocks or cards, but very soon anywhere that she could find them, in ordinary text. She took, also, a spontaneous interest in these discriminations, and as soon as she knew that names

attached to the letter forms, desired to learn them (I, p. 58).

It is certainly instructive to notice that at an age when she was totally unable to comprehend the naming of such perceptions as red and yellow, she was begging to be given names by which she might distinguish the forms O and Q (12th month). I have no doubt that the names of the principal plane figures and of the letters of the alphabet were withheld from her long after she could have learned them with ease and pleasure. Her instant understanding of the names of the plane figures at a year and a half old; her deep interest in them; her efforts to draw them and her pleasure in having them drawn for her; her easy comprehension of the essential trait of form in oblong, triangle, and ellipse, even when they varied much in proportions and size; and especially her interest and joy in finding the world about her full of plane forms, her glee in detecting oblongs in the door panels, triangles in corners of collars, etc. (I, pp. 58-67),—all this made one of the most remarkable episodes of the second year, and affords a pedagogical suggestion that should not be thrown away. That a child of 22 months could instantly grasp the distinction of ellipse and circle, while at the same time classing long and short oblongs together without difficulty, seems to me most noteworthy.

The same cleverness in geometric perception was observable throughout the third year. It was merely visual, however, and did not include any comprehension of the numerical relations in geometric figures; witness the incident on page 102, Vol. I (33d month), when the child was unable to understand why I could not lay a square for her with *five* sticks.

I find no other record of direct experiment upon a child's perceptions of plane figure. But the readiness with which small outline representations are recognized is noted repeatedly; and also the ease and interest with which the letters of the alphabet are learned, in playing with ordinary building blocks.³⁶

³⁶ O was named to Mrs. Tilley's younger boy in the 15th month. A few days later he pointed to a blue tile and called his mother's attention to a circle on it, pursing his lips and trying to say "O," and delighted when his mother named it. About four weeks later, he brought his mother the

Of any liking for symmetry in form, I saw nothing before the circular handle of a basket, saying "O." Toward the middle of the third year he began to ask the names of the other letters.

Mrs. Catterall's boy, by the 23d month, had picked up all the letters, apparently somewhat against the pedagogic theory of his mother, for he was "restrained from learning anything more." Mrs. Hoyt's daughter by the 25th month, Mrs. Tilley's older boy by the 26th, had learned all the letters in playing with blocks.

The following note, from the unpublished record of Mr. and Mrs. Cooley is too important an illustration of the precedence of form recognitions over color recognitions to be abbreviated:—

"He had a box of Bradley's blocks. These are red, blue, white and yellow; some have letters on both sides, some figures and letters; the letters are script as well as Roman, and there is also a German alphabet. Twenty-four have animals on one side, and figures or letters on the reverse. R. soon learned to select the picture blocks by the names of the animals. . . . In the 16th month, his father tried to test his sense of color with these blocks. Selecting a red and a blue block, he showed R. the red one, saying, "Red block"; then placing the two before the child, he asked for the red one. R. failed to understand. He selected either block at random; when by chance he took the right one, a demand for another red block completely nonplussed him, though he understood the word 'another' very well. He would take from the general stock another block of similar size and shape, but of any color. Other colored objects, books, balls, ribbons, were tried with no better results. Finally the blocks were tried another way. It seemed reasonable to suppose that, playing daily with them, the child might have learned to associate the animals he was so fond of picking out with the tint of their respective blocks. So a red block with the cat was placed, reversed, with several others, blue, white, and yellow, and R. was asked to find the kitty. He took the right block after one quick glance. The experiment was successful with the other colors also. But in a few days it was suspected that R. had more than color associations to help him. Accordingly, six yellow blocks, *letter side up*, were placed before him, and he was asked for an animal on one of them. He chose the block at once. Then larger collections were tried, and of all colors. The result was that out of the whole collection of 74, he knew, *by the characters on the backs*, the 24 animals. The backs did not bear a single letter, but two capitals and two small letters each: thus the goat was marked W w X x. The camel was once retired for three weeks, then replaced unseen, and found when asked for with no hesitation whatever. R. seemed curious to have some name for each block, and would often hand one up, pointing with interrogative grunts to the English or German letters. We were not anxious to fill his memory with symbols for blocks, but he learned in some way two of the letters, and the numerals from 1 to 10 (6 and 9 were of course interchangeable, as he had no means of telling when a block was upside down)."

The parents seem to have refused to follow the child's lead in the matter, but by the 34th month he had managed to learn all the letters.

fourth year,⁸⁷—nor, for that matter, of any æsthetic preferences among forms. The theoretic beauties of the circle were absolutely nothing to the child; her only basis of preference was ease of holding and handling, when the forms were represented by cardboard tablets.

5. INTERPRETATIONS.

Distance.—I have already pointed out (p. 72) that even before the development of grasping, the baby had some data for distance estimate, in the feelings of passive movement when she was carried to and from objects, associated with the corresponding changes in feelings of accommodation in her eyes, and in the visual appearance of the objects; and also from the associated series of touch and movement feelings when the hand was carried across a surface. With the mastery of grasping, variations in the distance of desired objects, measured both by eye and by arm movement, came to the very front in hedonic importance. Nor were they measured by eye and by arm movement only, for the arm-reach was supplemented by leaning, turning, and bending the body. Objects, moreover, were not merely reached after, but pushed and pulled to and fro, or the hands passed over surfaces, while the eye watched. After the sixth month, locomotion, beginning in efforts to get the body nearer to objects beyond the reach of the arm, developed steadily, and the child became able to measure off longer and longer distances by creeping and toddling.

From the fifth month, then, distance variations within a range at first little beyond the child's arm-reach, and steadily widening to her ordinary and familiar walking distance, must have become well systematized to her consciousness, in terms of visual appearance, of eye movement, of touch, and of many movements (both felt and seen) of arms and body.

Such a focusing of different sense experiences must sooner or later give the common element in all the perceptions a high abstractness. To what extent this abstraction of the feeling of distance from the feelings of muscular effort and visual change

⁸⁷ "Notes on Children's Drawings," Elmer E. Brown, University of California Publications, Education, Vol. 2, No. 1, 1897, pp. 23, 62.

may have progressed at any given time within the first three years, I will not venture to guess. It is likely that to a year-old baby space within the compass of a room's width about him, to the three-year-old space within a garden's width, is measured off into distances that are seen much as we see them,—only longer, in so far as the valuation is based on the effort of traversing the spaces.

On the other hand, beyond the range familiar to muscular effort, my niece evidently saw distance very short, and objects correspondingly small and near. In the 18th and 19th months, the moon floated just beyond the reach of the arm, a tall man a hundred feet away seemed to be a boy much nearer; late in the third year, such an error was made only at the distance of perhaps a mile (I, pp. 20-21). We constantly make the same sort of error ourselves, seeing distance as too short, beyond a range pretty well measured by experience.

Under the head of Accommodation (p. 66) I have already given a comparative table of the increase of distance range of perception, which has some bearing on the present subject; for imperfection in the visual definition of objects outside a limited range of seeing, probably affected distance estimate. But its difficulties were mainly due to inexperience only, after locomotion was fairly established.

Size.—Such a conception as that of the “real size” of an object must be very slowly acquired by a baby, after much tactile investigation. At the time accommodation is acquired, he has not yet come to a perception of objects as identical wholes (p. 74). When that perception does form, therefore, it is based upon objects each of which is seen at varying distances, and so subtending various angles in the eye. The baby learns to recognize his mother's face from the first with entire impartiality whether it be seen as six inches or two inches long. It would not be quite true to say that there is no such thing as real size to him visually,—that one size is just as real as the other (for even before hand investigation has set a standard of size, other senses have checked sight somewhat; the mother close enough to touch and minister to the baby would seem the norm, rather than the

mother across the room); but it would be nearly true. My niece's indifference to size in identifying objects was quite striking; even at three years old, an elephant was an elephant, recognized easily in a three-inch toy, in a wooden sign some two feet high, and in the massive animal himself. And this is natural enough, when we remember that the living elephant seen some fifty feet away, was no larger than her toy.³⁸

It is conceivable that the child may for a time tend to think of objects as actually diminishing as they retire. But at some time in the process of conception forming, the eye yields to the evidence of joint hand and eye experience, and the mother across the room is regarded just as large as at arm's length.³⁹ By the time the words *big* and *little* are used,⁴⁰ the child must rest upon some sense of fixed and real size in objects. I found that at three years old, indifferent as my niece was to size in recognizing the elephant's form, she had a pretty fair idea of what his size actually was, in terms of other objects (I, p. 105).

I append a comparative chronological table of the appearance of words indicating size concepts, up to the close of the second year:—

³⁸ Here we have probably the explanation of children's ready recognition of small photographic representations, and other pictures of known objects. The father in the photograph is no smaller than the father to whom the baby waves his hand daily out of the window.

³⁹ In adult life, as is well known, this empiric correction of the visual angle, by which a man across the garden actually *looks* to us life-size, fails rapidly as soon as the distance is sufficient to blur the detail of the image much. There is reason to think that this is still more the case with little children; and with a young infant we may safely conjecture that the apparent size of objects falls off very much more rapidly with distance than to our eyes. No doubt, too, the infant's belief, so far as he attends to the matter at all, is at one with his sight; unless the distance is so moderate and the object so familiar that the empiric correction has been securely made, he must really regard the distant object as smaller. Here may be part of the reason why a little child so readily believes in transformations of size (Sully, *op. cit.*, pp. 98, 105). (See my paper, "The Visible World of a Little Child," *University of California Magazine*, March, 1895.)

⁴⁰ The words at first meant "larger" and "less," used only together, of two objects compared with each other, even though varying but slightly in size; within two or three months they came to be used more as we use them, to compare an object with a medium or average standard of size; but the earlier use was apparent up to the 23d month (I, p. 66).

TABLE XVI. EXPRESSION OF SIZE CONCEPTS.

OBSERVER.	WORDS.	DATE OF APPEARANCE.
Hall	big	16th month (record closes with the 17th month)
Shinn	big, little	17th month
Price (1st child)	big, little	20th month
(2d child)	little	20th month
Sully	big	21st month
Wood	big	21st month
Tilley	big	22d month
Gale ^a (2d child)	big	Before 23d month
	tiny	23d or 24th month
	wee	24th or 25th month
(3d child)	large, little	23d month
Moore	little, big, great	By end of 2d year
Holden (both children)	little	By end of 2d year

Direction and Locality.—We have already seen (pp. 72, 113) that by the time auditory and tactile-motor contributions come into union with visual, the child has already begun to make some inferences of direction and location in space. In the 19th week my niece first showed the expectation that an object might be found on an extension of the line in which it had passed out of her field of vision (I, p. 23). But at six months old, she still rested on unintelligent expectation from experience in matters of direction and locality not quite so simple. Having been ac-

^a In the first half of the third year, Mrs. Gale's oldest child also used adjectives of size, viz., big, wee, and large; the second child added little, large, small; the third child tiny and small. Mrs. Hoyt's older daughter used big, little, and small in the first quarter of the third year. I have no tabulated records of speech in the third year from any other source; but I think words descriptive of size will always be found in use early in the third year, unless the child is slow in speech development.

Mr. Cooley mentions here an interesting bit of early synesthesia. His boy in the 30th month, in naming two things of the same kind, but of different size, always named the small one first in a high and squeaky tone, then the larger one in a low note. Later, the high tone was always used to express small size, even when no contrast was involved. His father thinks this may have come from comparing the bark of large and small dogs. But I think most children use more or less this method of expressing vividly the contrast of large and small—and indeed, in talking to children of the "little, wee bear" and the "big, big bear" and the like, we do it ourselves, quite instinctively. We see the same synesthesia reversed in my niece's description of high notes as "little" (21st and 22d months, I, p. 118).

customed to watch people leaving the room by a certain door, and at once becoming visible outside through the window.⁴² she turned and looked out of this window expectantly when her mother left the room by an *opposite* door, which she was not in the habit of using; but when I left the room by this door, which I used daily, or her mother by one that led to her own room, the child never thought of looking through the window for us. At the same age, however, when taken once out of a room, and back into it by a novel cross-cut, she showed by her surprise that some vague preconceptions of locality and relations of places were present to be jarred (I, p. 88).

By the seventh month, her attention could be drawn imperfectly in a given direction by motioning with the hand, but she could not follow a pointing finger accurately till the 9th month.^{42a} Her own pointing developed later than this, and apparently not so much from any idea of indicating a line of direction, as from a habit of reaching the hand toward a desired object, as if to grasp. After she could creep and walk, her understanding of the location of objects seemed clear; but even at two years old it was more disconcerted by darkness than ours (I, p. 24), and this may not have been wholly because direction was more purely visual with her than with us, but also because in the light she steered a good deal by known objects, instead of by any general feeling of direction. It is well known how easily children, even of five or six years, get lost as soon as landmarks are out of sight.

Direction up and down is probably not systematized to the baby's perception as early as direction right and left. He has much early motor experience of up and down, as he is lifted and lowered, and he gazes upward a great deal in the early months, when he lies upon his back. But there is little opportunity to carry the eye up and down, and to verify visual experience by tactile-motor, until he is sitting up, and looking from one object to the other, higher and lower. I know no record of the progress

⁴² A note of Mrs. Hall's shows her baby forming ideas of direction and position by a similar practice, in the 37th week.

^{42a} In the 6th month, Mrs. McLeish; 9th, Mrs. St. John; 11th, Mrs. Hall and Mrs. Beatty.

of this interpretation, except in the practice (common to all babies, I suppose) of throwing objects down and watching them as they fall, and as they are picked up. It is no doubt the motion and impact of the falling object that makes this experiment so deeply interesting to the infant investigator, but he gets the space interpretation from it incidentally. I have already given citations (p. 148) showing that the development is very irregular in the time of its appearance; but it may be roughly credited to the third quarter-year.

I saw my niece in the 41st week (I, p. 347) creeping to each corner of the hall in succession, to sit down and run her eyes up the walls. No doubt babies familiarize themselves with this space interpretation in many such ways, which we fail to note.^{42b}

Solidity.—With the period of joint hand and eye investigation, a certain distinction between plane and solid form developed at once to the baby's consciousness. She learned, that is, to distinguish which type of visual objects could be laid hold of and which could not. After the 20th week,⁴³ she scarcely ever tried to pick up shadows, figures in the table-cover, and the like,—making really no more errors than a grown person might do among objects so novel; we ourselves are easily deceived as to the solidity of objects by a slight change in the distribution of light, for instance. But it is significant that when the baby had mistaken a plane figure for something that could be grasped, she did not instantly recognize the mistake on touching it, but in several instances kept up somewhat persistently the attempt to get hold of it. An adult has the categories of plane and solid so thoroughly differentiated in conception that a touch reveals

^{42b} My nephew, up to the 10th month, has been conspicuously diligent in exploring space upward with his eyes, as in gazing up a staircase well, or up the trunk of a tree to the branches.

⁴³ Mrs. Beatty and Mrs. Catterall both mention grasping at plane figures as conspicuous in the first week of grasping, but do not record it later; Mrs. Cook saw it in the second month afterward, Mrs. Conard in the third, and Mrs. Tilley until after the baby was nine months old, and had been grasping freely for more than four months. I have no record of anything that seemed to me a real confusion of plane and solid in my nephew for more than two weeks after grasping had become a habit, in the 6th month.

to him his error,—even changing the whole aspect of the figure to his eye, so that he cannot make it look other than plane, when a moment before it looked solid.

Even at nine months old, when much practice in handling bodies and feeling over surfaces had made my niece well able to distinguish them by sight, and no error had been made for about three months, she persisted in trying to pick up the shadow of a swaying rope end. The motion brought it within the category of things that could be grasped, in her experience, and she followed experience, not any general conception of the difference between surface and solidity. The confusion was never made later than the 9th month, however; and by the 11th month, outline figures seemed to be accepted for what they were, without the least expectation that they could be perceived by touch.

To differentiate seizable figures from plane outline, however, is a simpler process than to learn to understand them, in their solid extension and form. The interpretation of a solid figure, I take it, consists in learning to infer its extension to hand investigation from its visual aspect, and then fusing the hand memories of it with the visual aspect so completely that it really *looks* to be what the hand knows it is. There is reason to think that this interpretation is but slowly worked out. It is a complex and difficult one. Each object must be perceived in outline on different sides, and these various perceptions indissolubly associated; and a similar extensive group of touch perceptions must be formed and fused with each other and with the visual group, before the object can be seen as solid; and this must be repeated for a number of objects before the association of a certain appearance with projection or recession of surface can be generalized, and later come to the clearness and instantaneousness of a single perception. Nor does there seem to be anything in this trait of solid extension that interests the baby, and fixes his apperceptive attention upon it. I never saw the extension and figure of objects deliberately investigated. The enormous amount of manipulation bestowed on them was devoted to other purposes. Surfaces were felt over for their texture; objects were turned over and over, pulled around, shaken, but the mo-

tive seemed to be the desire to feel and to see the thing move under the hand, to work a change upon it, not to satisfy curiosity as to its form.

I have no doubt, however, that in the course of this handling a general interpretation of the solidity of tangible objects was very soon made, so that near and familiar ones, at least, came to be seen as solid. The visual and tactile images of our features must have been well fused in the 14th month, when the baby could locate and recognize them in the dark (I, p. 142). But while the general idea of solidity may have become well fixed, and even the specific forms of a few familiar objects fairly defined, I doubt if more than a few were thus known, early in the second year.

At 22 months old, the child was taught the principal solid figures (cube, cylinder, and sphere), with considerably more difficulty than the plane figures had cost at 18 months; and there was a marked disposition to recognize them by their faces, calling a cube a square, a prism an oblong, a diagonally bisected cube a triangle (I, pp. 68-70). It was hard to get the child to generalize these forms, so far even as to accept blocks of larger size under the same category as her small cubes; and though before the end of the third year (35th month) she could recognize the solid forms in nature when asked, she never noticed or named them spontaneously (I, pp. 102-3). It was impossible to interest her much in their properties, or in any of the kindergarten manipulations of them.

Understanding of Pictures.—The earliest demonstrations of interest in pictures, recorded in my own notes and those of others, are far from showing any understanding of the purpose of the picture. It is a conspicuous object, hanging on the wall or displayed in a book, and excites attention and curiosity, just as a conventional figure in a carpet does. Even when the child has been taught to recognize the picture by name as "Mr. Longfellow," or "Bébé,"^{43a} the name means, as M. Taine says, nothing more than "something variegated in a shining frame."

^{43a} I, p. 71; Taine, *op. cit.*, p. 26.

"The objects drawn or painted in the frame are as Greek to her." Yet the infant sometimes shows a peculiar interest in these mysterious objects, about the last quarter of the first year. Possibly their very meaninglessness excites his curiosity, at a time when he is just investigating everything, and usually finding some content in the way of movement, noise, tangibility. However that may be, a period of uncomprehending interest in pictures seems always to be followed soon by a discovery of their resemblance to known objects,—aided very likely by suggestion, as the elders name the picture to the child.

This discovery dawned on my niece, I thought, late in the 10th month, and was fairly accomplished in the 11th (I, p. 72). Horses, dogs, flowers, and even such minute features in pictures as a ball, eyes, etc., came quickly to recognition; but photographs of known persons not till the 14th month.

The fine visual discrimination and close attention shown in these early recognitions is wonderful. My niece in the 13th and 14th months would point out "kitty's eyes," "the man's glasses," feet, etc., in small pictures; at 19 months, the beaks of birds,—and this with much spontaneity. Mrs. Hall's boy in the 14th month recognized a dog half an inch long, and pointed out the shoes in a picture of a doll, in which the doll itself was only $\frac{7}{8}$ of an inch long.

The interest shown by the little ones in these recognitions is endless. At first it seems to be simply a joy in perceiving the resemblance, something akin to their joy in fitting concepts with names. There is a deep and primitive delight to the child, from the earliest synthesis of senses, in bringing a whole range of perceptions into parallelism with another range,—a pleasure well in accord with the Spencerian "economy" theory. I must refrain from any discussion of this, however, for it would carry me far beyond the topic of the senses. Later, the simple delight in discovering resemblances, and in becoming acquainted with a pictured world corresponding to the real world, becomes more complex and intellectual. The child takes an interest in the story of the picture; ideas are profusely suggested; the picture becomes

the key to a greatly widened psychic life, and the source of remarkable enjoyment. This advanced stage I dated, in my niece's case, from the 18th month (I, pp. 76-7).

The following table gives comparative dates for such stages of progress in understanding pictures as I find generally recorded:—

TABLE XVII. UNDERSTANDING OF PICTURES.

	DATE.	OBSERVER.
Earliest recognition	8th month	Hall, Daniels (girl), Hoyt (boy)
	10th "	Shinn (girl and boy), Tilley
	11th "	McLeish
	12th "	Wood, Cook
	13th "	Moore, Pollock, ^{ab} Cooley
	14th "	Catterall
	15th "	St. John, Taine
Recognition of photographs	11th month	Tilley
	14th "	Shinn
	15th "	Daniels (girl), Hall
	16th "	Wood
	25th "	Preyer
Story of picture interests; complex ideas suggested	18th month	Shinn
	21st "	Cooley, Moore
	23d "	Hoyt (boy), Tilley (1st boy)
	28th "	St. John

Of the "earliest recognitions" in this table, none of those dated in the second year seem to me to have really been "earliest." Either the child had not been tested with pictures before, though he might have proved well able to catch the resemblance to the object; or else the entry seems to have been made when the recognition, though still new, was not quite in its earliest stage. So, too, the entry that seems to date the more complex interest in the third year did not, apparently, record the phase

^{ab} See bibliography in Prof. E. E. Brown's "Notes on Children's Drawings," University of California Publications, Education, 1897, and later titles in the annual Child-Study bibliographies of Clark University. But I must mention especially, for an able consideration of the questions relating to this very early period of interest in pictures, Prof. Sully's chapter on "The Child as Artist," *op. cit.*, p. 298.

at its first appearance. We may fairly enough, then, set down the dawn of recognition of pictorial representation as a development of the last quarter of the first year; the recognition of photographs (that is, of specific and individual resemblance in pictures) will appear about the first quarter of the second year; and interest in the story of the picture and in a considerable range of suggested ideas, in the latter half of the second year.

When we consider how much there is that is conventional in our system of pictorial representation, it is remarkable that the child is able so early to relate the picture to the object, and so greatly to enjoy and profit by this art language. The comprehension is even carried so far that the real object is recognized from the picture. Thus my niece in the 36th month recognized an elephant; and Mrs. McLeish's little girl recognized cows, as early as the 14th month. I should be going beyond my topic, again, if I entered upon the interesting subject opened up by this precocious readiness of the child mind for pictorial art; and it is a subject that has already been ably discussed more than once.^{48b}

II. HEARING.

1. SENSIBILITY AND DISCRIMINATION.

In the chapter on Auditory Associations (pp. 119 *et seq.*) it has been shown that cochlear hearing, appearing about the end of the first month, was in all recorded cases fairly good before the period of sense synthesis was over,—by the sixth month at latest; in one or two cases, the responsiveness to sound was remarkable by the 5th month. My niece did not show a really lively responsiveness till the 9th month (I, pp. 108–9); at this time, she would stop and listen at the slightest novel sound, distant or near,—if a horse stamped, outside the house, fifty feet away, or if a pencil dropped on a matted floor. This phase of remarkable auditory alertness lasts a month or two and then passes away; it probably indicates a sudden advance in susceptibility to sound, which interests intensely while it is novel, and

then comes to be accepted as a matter of course. I do not find it mentioned at all, however, in most records.⁴⁴

It is evident, however, from scattered notices, that hearing does become more acute throughout most of the first year. For some months this is apparent in an increased sensibility to auditory shock,—the child starts and winks more readily at slight, sudden sounds; but on the whole, as cochlear hearing develops, the element of shock in sound is less noticed,—or perhaps it is only that the reflex excitability becomes less.

There is from the first a hedonic sensibility to differences in sound, long before intelligent discrimination and recognition are present. Jarring or startling sounds are almost always disagreeable, while music, from the first establishment of cochlear hearing, affects all children agreeably. Sounds of more neutral hedonic quality differentiate later to the ear; but the human voice is apparently in a general way differentiated from other sounds as early as the second month (p. 120 *et seq.*). By the 5th month my niece began to show that she perceived differences in quality between individual voices in the family.⁴⁵ Differences in tone are also perceived, even earlier than this, but their hedonic effect varies with different babies.⁴⁶ At about the same time that differences in voice were perceived (5th month), my niece showed discrimination between verbal

⁴⁴ Preyer's child reached the phase in the 5th month; Mrs. Tilley's older boy in the 6th; Mrs. McLeish notes it as beginning in the 5th, and culminating in the 8th. It appeared in my nephew in the 9th.

⁴⁵ *Recognition* of voices is a more advanced development, requiring the association of each one with the speaker. I find this dated in several records (p. 193); the earlier stage, mere perceptive discrimination, only in Mrs. Tilley's MS., where it is assigned to the same month as in my notes, the 5th.

⁴⁶ From the 3d month, Mrs. Hall's and Mrs. Cooley's babies were painfully affected by shrill tones; Mrs. Cook's, from the 3d to the 7th month, laughed immoderately at imitations of peeping or mewing, and also of grunting, but was frightened at growls; my niece from the 6th month, for some weeks, was made very uneasy by a deep, vibrating voice. Mrs. Saunders's boy as early as the 7th week, Mrs. Tilley's in the 3d month, Tiedemann's and Preyer's sons and my nephew in the 6th, cried at a harsh tone; my niece, at six months, stared, then laughed, when the same experiment was tried with her several times.

sounds, certain combinations of consonant and vowel exciting her to gayety. (I, p. 112).⁴⁷ From the 6th month, the increasing ability to distinguish spoken words showed a fine auditory discrimination. This is noted in other records as beginning from the 5th to the 12th months (see below, p. 196).

2. MUSIC.

Musical Sensibility.—All infants, so far as any observer has recorded, experience pleasure in musical notes, from the beginning of cochlear hearing,—as early, at all events, as the second month. The pleasure must be wholly direct and sensuous, to appear so early, and no doubt has to do with the exact mathematical adjustment of the musical vibrations to the physiology of the organ of hearing. The agreeable effect of single notes and chords (which was apparent in my niece earlier than any interest in regular tune) is about as simple as that of light falling upon the eye.

After the middle of the second year my niece desired real playing, not mere scales and chords (I, p. 117); and her enjoyment of music was at times quite vivacious. But it was certainly not a consistent and dominant pleasure at any time within the first three years of her life.

Other children may have shown more decided pleasure in music; the records are not full and consecutive enough to enable me to tell. On the whole, one gets an impression of less musical susceptibility in the American infants than in the German ones mentioned by Preyer.

Sense of Rhythm.—The feeling of rhythm is of course not wholly—nor even primarily—an auditory one; but it is most easily considered in connection with music.

It might be possible to determine by experiment how much of the pleasure in music shown by young infants is due to rhythm, and how much to tune, but it has never been done. My niece, before the end of the second month, could be diverted by lively music when slow music failed;⁴⁸ and strongly accented music

⁴⁷ Mrs. Tilley, 6th month.

⁴⁸ Mrs. Daniels's boy, in the 4th month, showed delight in "bright, fast music—crying if it is loud or sad." See also Tracy, *Psychology of Childhood*, I, p. 95.

moved her unusually (with astonishment) in the 4th month (I, pp. 115-6). To be danced with, in some one's arms, in time to music, gave her extreme delight in the 16th month; and her first recognition of tunes, in the 25th and 28th months, seemed to rest more on their strongly accented time than on the melody. Nevertheless, she could not be taught, at any time in the first three years, to march or keep time to music in any way, or even to keep step with us; it was not till the 30th month that she could even learn to swing a ball to and fro in rhythm, or could say "far—near," in time with the movement. In trying to sing herself, she could not approximate the time of any melody until the 30th month.

I judge from the silence of most records that my niece's development did not differ much from that of the average child in the matter of ability to keep time: but as will be seen by the table below (p. 191), there are several cases of good sense of rhythm early developed.

Pitch and Tune.—The emotional effect of extremes of pitch upon infants is early apparent.⁴⁹ But it was not until the 18th month that my niece attended to them consciously, reaching up and down the keyboard to strike contrasting notes, and calling high notes "little" (21st and 22d months). She could not take any pitch with her voice before the 4th year. Until the 26th month, she was utterly incapable of understanding what was wanted when a note was given her to imitate, and would shout it back without an effort at pitch or musical tone. After this, she gathered some idea of making an interval in pitch, but could not do it with the least correctness; still less could she approximate any air, however familiar (I, pp. 122-3). She had not even recognized any air before the 25th month, and then it seemed to be more by time than by tune.

In this respect, as in sense of rhythm, I find few children reported much earlier in development than my niece;⁵⁰ but here also

⁴⁹ See note 46, p. 186. But high notes on the piano do not displease, as in the human voice. "The higher the better for him," Mrs. Tilley notes in the 3d month. See also my "Notes," I, p. 118.

⁵⁰ During later childhood she developed a fair average musical taste, and correct perception of time and pitch.

some children show marked precocity (see Table XVIII, below).

Spontaneous Musical Expression.—It is important to notice that while efforts to impart our own musical development to the baby fail, except in cases of precocious musical endowment, there is usually a sort of spontaneous and primitive musical development going on, along somewhat different lines.

In almost all cases, the sound of music seems to excite the baby, almost from the first, to a motor accompaniment, either of limbs or of voice,—but purely as a discharge of the emotional tension produced by the music, a self-expression, without the least attempt at imitation of the sounds, either in time or tune. Thus, at about two months old, my niece would accompany music with a soft, singing sort of coo; at eight or nine months old she would contribute wholly unrelated notes of her own when others were singing; at a year old, she kept up a low crooning while falling asleep,—apparently an expression of a general mood of comfort, similar to that which music induced; but possibly a reminiscence of her mother's lullabies.

In the 18th month, she began to amuse herself with a sort of tuneless chanting or crooning of syllables, which became a regular expression of happiness while she played about. The pitch scarcely varied from a monotone during the second year, but during the third it grew more varied, rhythmic, and modulated, until—while quite without any real tune, or even recognizable intervals—it had a pleasing and musical effect. The child's joy and spontaneity in this exercise, and the degree of real music there was in it, contrasted significantly with her reluctant and ridiculous efforts at civilized songs. During the whole third year she occasionally chanted in words, sometimes mere fragments, sometimes quaint little improvised verses,—sometimes touching the piano softly as she improvised, sometimes dancing about joyously. In the next two years, these improvisations sometimes actually attained to correct rhyme and metre; but as the little girl became able to sing in more sophisticated fashion, and learned to enjoy the poetry we gave her, this primitive art died out.

I find instances in other notes, both of the early cooing to the sound of music,⁵¹ and of the later primitive chanting,⁵² while still unable to reproduce our music; and I am inclined to think that both occur oftener than has been recorded. The chanting is in fact, like that of primitive peoples, a sort of recitative, which could probably be analyzed into imperfect musical intervals.

Summary.—What we may call a normal musical development, then, in the first three years, does not go beyond a pleasure in listening to music, especially to lively music with well-marked time; and this pleasure, though real and universal, is not one of the foremost to the child.⁵³

It is rarely that the mathematical accuracy of rhythm and pitch required by our music can be attained before the fourth year; but left to a natural outflow of musical expression, the child starts out to develop a musical system for himself, from its crude primitive beginnings.

There follows a table of the comparative chronology of musical development, so far as I can find it recorded for different children; the silence of most records seems to imply absence of such development.

⁵¹ "The mother's singing soothed the child, so that he ceased crying to listen to it, and when to the rhythm of the music she swayed his hands, held tightly in hers, he crooned a soft, continuous musical tone as long as the singing continued." (36th day.) Mrs. Hall, *op. cit.* See also MS. of Mrs. Tilley.

⁵² Mrs. Tilley's younger boy, from the 15th month to the 28th (when the record in my hands ends), developed a habit of singing "tunes of his own making" with a fairly musical voice, but no regular intervals. See also Preyer, *The Development of the Intellect*, pp. 171, 185; Mrs. Moore, *op. cit.*, p. 62; and the MS. notes of Mrs. Daniels.

⁵³ I can find no evidence anywhere of a susceptibility in the child to a hypnotic sort of excitement through rhythmic motion, such as is familiar to the anthropologist. Probably the baby is at a still earlier stage of musical development; and before he has acquired the savage's susceptibility to musical excitement he has been diverted by teaching to our more controlled and quieting musical system. Or it may be that he has not yet the passions and impulses that music can work on strongly. It is certain that the sight of a dog or cat, the achievement of some feat of self-activity, the prospect of going outdoors, will throw a baby into a condition of excitement and joy that no one has yet recorded as caused by music, even in the case of the most musical babies.

TABLE XVIII. DEVELOPMENT OF MUSICAL SKILL.

STAGE OF DEVELOPMENT.	DATE.	OBSERVER.
Keeping time to music by movements	12th month	Chapman ⁵⁴
	At a year old	Wells ⁵⁵
	Nearly two years old	Preyer
	Not yet seen, at 32 mos.	Tilley ⁵⁶
Recognizing an air ⁵⁷	Not before 4th year	Shinn
	20th month (2d child)	Tilley
	21st month (1st child)	"
	28th month	Shinn
Giving a note or interval correctly	8th month	Safford ⁵⁸
	9th month	Friedemann, cited by Preyer
	28th month	Tilley
	Not till 4th year	Shinn
Singing an air correctly	15 months	Helliwell ⁵⁹
	"Before they could talk"	Friedemann, cited by Preyer
	2½ years	Observer cited in the Talbot papers—child in Holland ⁶⁰
	Nearly 3 years	Preyer, Daniels
	Not till 4th year	Shinn

3. INTERPRETATIONS.

Source and Nature of Sound.—The mere association of sound with visual and muscular experience is soon made,—by the 4th month, in almost every case (p. 130). Its interpretation as something originating in an objective source, and made by some process of movement, and the reference of various sounds to their proper origin, begins from the fourth or fifth month, and is actively in progress throughout the second year, at least. At

⁵⁴ The same child by his 20th month could keep the polka step for six measures at a time.

⁵⁵ Letter of Mrs. Flora Ellis Wells. The mother is herself a musician.

⁵⁶ The same child, in the 32d month, in repeating songs, would fill out the rhythm and accent correctly, where he had forgotten the words. Mrs. Moore's child did this in the 22d month.

⁵⁷ Mrs. Moore reports this in the 17th week. The date is so extraordinary that I do not venture to insert it in the table—the more as Mrs. Moore does not give the observation in detail, but merely states the item.

⁵⁸ MS. of Mrs. Gertrude Sunderland Safford, Michigan University, 1895. The child followed the notes of a cuckoo clock almost invariably with an

"m'm
 \ in the two pitches. The same child in the 11th month imitated
 m'm,"
a passage of staccato singing.

⁵⁹ Several songs.

⁶⁰ A mere fragment of an air.

what stage the interpretation really takes form, it is hard to say. By the time the child asks, "What made that noise?" "Where did that noise come from?" he must understand the origin and nature of sound much as any unscientific grown person does. But I do not find record of such questions within the first three years.

One thing is evident: the interpretation must take two directions in his mind. (1) The sound by means of which he first begins to associate sound with a visual source at all, the human voice,—the sound which somewhat later becomes the most interesting of all to him, in connection with his own vocal activity,—never comes to seem to him in need of accounting for by any movement or impact of objects.^{60a} It becomes a factor, on the contrary, in his feeling of the self-activity of living beings. (2) His own manipulations of objects to produce noises, however, and his observation of their production by the acts of others, by falling bodies, etc., must build up in his mind a conception of all noises except the voice as somehow made by a visible process of movement.

This process of interpretation could be seen beginning, in the case of my niece, early in the 5th month, in a lively and wondering interest in watching the making of noises. Unless she could see the noise-making process, sounds did not greatly interest her. In her own noise-making,—ringing a bell, blowing a whistle, rapping things together,—she did not at any time seem to me to care so much for the sound in itself as for the relation of process and result. After making a sound by her own act, she would ask to see it done by others (9th–13th months, I, pp. 129–30). She was interested especially by *novelty* in sound, or in the method of producing a familiar sound; thus in the 14th and 15th months, she did not care so much for her rubber doll's squeak in itself as for making it squeak in irregular ways, by stepping on it, or jumping it up and down. Throughout the whole three years, sounds were a source of lively interest, but not from pure sense pleasure in them: the child wished to see what made them, how it was done, and to get them referred to recognized sources. The first sounds thus referred were the

^{60a} For this note, see p. 222.

voices of the family, one by one, from the 8th or 9th month to the 11th;⁶¹ few other sounds within the first year; but in the second everything was recognized and referred to its source.

All records that I have examined confirm my own in the above observations. That is, the child's interest in sounds is always considerable, and develops remarkably in the second year; but except in the case of music, it is not a pure sense pleasure. There is practically nothing of the "noise-hunger," as President Hall calls it, which really does seem to exist among older children. Of the babies, even the noisiest was evidently interested more in producing effects by self-activity than in filling his ear with sound. Professor Preyer and Mrs. Hall both record instances in which the child's curiosity about variations in a sound led to experimenting of a remarkably intelligent sort for children so young.⁶²

With all his observations and experiments in the origin of sound during the second year, it would seem as if the child, by the latter part of this year, should have a fairly clear elementary interpretation of the nature of sound. But it is possible that in case of a sound which seems unaccountable, as the wind, or an echo, a child can still, at this age, become confused, and fall back upon the conception of an *object* (p. 127). My niece, in the 20th month, puzzled by an echo, begged to "find the noise," "see the noise," and I could not feel sure how far she was merely unable to express the conception "thing-that-made-the-noise," or how far a sound that did not come under known categories as to origin, might be attracted over, so to speak, in her mind, into the better-known category of objects.^{62a}

⁶¹ Sigismund and Mrs. Hall, 5th month. Demme, cited by Preyer (*op. cit.*, p. 91), found two children, out of about 100 tested, who seemed to recognize the voices of their parents at 3 and 3½ months. This was a more primitive sort of "recognition," a mere hedonic association with the sound, not an interpretation of it by definite reference to a known source. It is possible that the recognitions noted in the 5th month were still of this type.

⁶² See the investigation into the cause of the dulling of sound when the child's hand touched the glass he was tapping with a spoon (11th month), Preyer, *op. cit.*, p. 87; and a similar instance (9th month), Mrs. Hall, *op. cit.*, p. 466. I have seen the same thing in my nephew (9th month).

^{62a} See Prof. Sully's instance of the little girl M., who asked to see a knock (*op. cit.*, p. 97),—"reifying" the sound, as Prof. Sully puts it.

The weakness of the sound-conception here is obviously due to its resting on the testimony of a single sense; on p. 197 I give a parallel instance of a weakness felt in the conception of a color, because it rested on the evidence of sight only.

Certainly my niece's consciousness of the act of hearing was less clear than that of seeing, for in the 21st month she could tell very well what she did with her eyes, but had not associated her ears at all with hearing (I, p. 133). The word "hear" did not appear in speech till the 21st month, "see" in the 18th; and in this evidence from speech all other records support mine.⁶³

Direction and Distance.—Within the earliest period of sense development, about the third month (p. 130), the child comes to a good association of sound with visual direction, if the source is near by, and nearly in the horizontal plane of the ear, to left or right. From this time, the more difficult inferences of direction develop, resting on accumulated experience and finer auditory discriminations. They seem to me to develop with remarkable ease and accuracy.⁶⁴ In the 14th and 15th months, my niece could run directly toward the sound of my voice in the dark; in the 19th, hearing a bell ring a mile away, she moved accurately toward the sound (I, p. 110). From the 6th month

⁶³ Prof. Holden notes "hear" and "listen" in the 24th month. I do not find "hear" in any other vocabulary before the third year, though "see" appears in all; one of Mrs. Gale's children, however, used "listen" in the 24th month, and "hark" appears in the two-year-old vocabulary of Mrs. Moore's child. "Music" is used early as a rule (Shinn, 17th month, Gale, 22d and 24th, Moore before 3d year), and also "noise" (Hall, 17th month, Shinn 20th, Gale 22d, Moore before 3d year); and also some names of specific noises, as "squeak," "bang," "tick." But if we pass over the naming of animals by their voices which is taught to children, and comprehended by them readily even before the second year (bow-wow for the dog, moo for the cow, etc.), and the imitations of animal sounds, the total number of sound-concepts in the vocabulary of a two-year-old child is very small. I find it ranging from one word up to some 15 or 16; while the concepts of fused visual-tactile character that are expressed at the same age, will range from 200 to 600—including nouns, verbs, and adjectives.

⁶⁴ Mrs. McLeish notes rapid development in turning toward sounds, even at half a block distance, or on another floor of the house, in the 5th and 6th months (*op. cit.*, p. 114). Mrs. Beatty also notes the accuracy with which the train bell and whistle were located, several blocks away, from about the same age.

she became slowly able to locate sounds further and further above her; but even in the 20th could not locate an electric bell directly above her head (I, pp. 109-10).

Her ability to infer distance from the sound also grew steadily, and from the 20th month she distinguished very well between a "choo-choo 'way off'" and one nearer, by the whistle, a comparatively easy sound for this discrimination (I, p. 113).

Language.—So far, I have spoken of no ear interpretations that approach in psychic importance those made by the co-operating hand and eye. But when the infant begins to associate a given vocal sign with an object, a feeling, an expectation, so that at sound of the word the associated idea comes to his mind, the ear begins to come to a psychic importance that is destined to outstrip that of the eye.⁶⁵

At six months, my niece had associated the long vowel sound in her name, pronounced in a calling tone, with some sort of prospect connected with herself, so that she would turn expectantly at a call, not only of her name, Ruth, but of Toots, or any other monosyllable containing the *oo* or *u*. At seven months old, she began to associate the names of members of the family with the proper persons, and so went on to an increasing knowledge of words. With the second year the number of vocal signs thus associated with ideas passed beyond enumeration, and the child had already begun to imitate them with her own voice. The acquisition of language, thus begun, was the great achievement of the second year.⁶⁶

The date of this attainment varies somewhat,—a little earlier

⁶⁵ "The great superiority of the ear to the eye, from the psychogenetic point of view, is but slightly prominent upon superficial observation of the child that does not yet speak; but we need only compare a child born blind with one born deaf, after both have enjoyed the most careful training and the best instruction, to be convinced that after the first year, the excitements of the auditory nerve contribute far more to the psychical development than do those of the optical nerve." Preyer, *op. cit.*, p. 182.

⁶⁶ See Romanes, *Mental Evolution in Man*, as to the precocity of the acquirement of language by children of our day. Four years, he shows reasonably, is an age corresponding better to the phylogenetic stage at which language was acquired than two years. The second year, however, is the year of language acquirement in the majority of cases recorded.

with some children, much later with others, as may be seen from the table that follows; but it comes about always in the same manner,⁶⁷—first the understanding of verbal symbols, then much more slowly the imitative use of them.

TABLE XIX. FIRST INTERPRETATION OF VERBAL SYMBOLS.

DATE.	OBSERVER.
5th month ⁶⁸	Cooley
6th month	Tilley (1st child), Shinn (niece)
7th month	Tilley (2d child), Hall, Sharp, Darwin, Shinn (nephew)
10th month	Taine, Moore
12th month	Preyer

III. TOUCH.

1. SPECIALIZATION OF SENSIBILITY IN THE FINGERS.

During the early months of life, it is amply evident that the center of touch sensibility is the mouth. For two months after grasping was acquired (5th and 6th months), in my observation, the superior facility of the hands for touch purposes was not realized. None the less, it was all this time utilized in various ways; and even while everything still went to the mouth and the hands remained subsidiary, the slight manipulations that were going on, re-enforced as they were by visual interest, were steadily drawing attention toward hand-touch. The peculiar advantage of the lips in tactile sensibility was also declining at this time, from the increase of sensibility all over the body; touches in sundry places were now noticed with laughter or surprise. The investigation of the body, also, involved movements the mouth was incapable of: the feet and legs were seized on as playthings; the head, neck, and face, touched by chance, were investigated, even to tracing the tongue down to its roots with the fingers.

⁶⁷ There is an element in the acquirement of language, that of spontaneous ejaculation, which has little to do either with understanding or imitation of sounds; but of that I need not speak under the head of auditory interpretations.

⁶⁸ This date is certainly precocious; but Perez credits the interpretation in a precocious case to the 3d month! I have not used the date in the table, doubting whether it was a first-hand observation.

By the 7th month the use of the hands for tactile purposes was visibly displacing that of the mouth. The practice of carrying objects to the mouth declined, and the baby when lifted to one's face, no longer put her mouth to it to feel it with lips and tongue, but seized at the hair to draw through her fingers. By the time she was a year old, she rarely put anything to her mouth unless to taste it.

Yet there were recurrences to the mouth-touch in the second year. In these cases, the object was usually first examined (sometimes for many minutes) with eyes and fingers, and thereafter carried to the mouth.⁶⁸ This points to what I think is a conceded fact,—that the fingers, though superseding tongue and lips as the touch organ, by virtue of their motor superiority and their co-operation with sight, never equal them in tactile delicacy; so that to the end, when the baby wishes to bring to bear a finer sensibility, he uses mouth as well as hands. I saw a curious illustration of this reference of a perplexing point to the lips, in the 20th month. It happened several times during my color tests that I said to the child, who seemed about to answer heedlessly, "Look carefully," and that thereupon she raised the little color tablet in her hand instinctively to her *lips*, to corroborate sight by touch at its most delicate.⁶⁹

In the 10th month the forefinger tip began to be preferred for nice investigations;⁷⁰ before this, the finger-tips were used all together. The thumb and forefinger tip were often used together now, which indicated that the preference was due rather to the freer position of the forefinger than to any inherent superiority; but no doubt that very freedom of position had given it an inherited advantage.⁷¹

⁶⁸ But no doubt in this later mouth-examination, after taste experience has become varied, there is often an intention of trying the taste of the object, as well as the touch.

⁶⁹ Here the realization that touch and sight usually give diverse and mutually supplementary reports of the same thing, over-reached itself in the effort to *feel* a color, as at about the same age the expectation that sight and hearing will support each other, in the effort to *see* a sound, p. 193.

⁷⁰ Out of this specialization of the forefinger in active touch, I thought, rather than by imitation, grew the gesture of pointing.

⁷¹ Mrs. Moore notices the differentiation of the forefinger, in the 8th month; I saw it in my nephew in the 9th.

All detailed records of infants, without direct recognition of this transference of touch interest from mouth to fingers, make it evident enough that it did take place, for notices of the mouth-ing of objects gradually give place more and more to notices of the handling of them.⁷²

2. FINENESS OF DISCRIMINATION.

Although, as I have said, contact sensibility in the fingers never came to equal that in the lips, the greater use of *active* touch made the hands, even apart from the aid of sight, organs of far more finely discriminated perceptions than the lips could give. From the time the fingers were fairly differentiated for touch purposes, therefore, from about the 7th month, an increasingly efficient exploration of the world by means of touch developed. It is impossible, however, to separate most of this from the subject of sight-exploration, since the two senses constantly co-operated. I have noted already how smaller and smaller objects were picked up and fingered,—down to a single hair in the 8th month; and so in other records (p. 147, and note 2). Even by itself the tactile sense of the fingers was used with lively interest; surfaces were explored, and novel ones, as the bark of a tree, the zinc under a stove, perceived with curiosity as unfamiliar. This was especially noted in the last months of the first year; in the second and third years, as experience grew more complex, such simple touch investigations interested less. During the fourth quarter-year the feet as well as the hands were used with much interest for feeling over novel surfaces, a practice which ceased when shoes with soles were put on.⁷³

3. INTERPRETATION.

The child's conception of an object, after a fair amount of joint visual and tactile investigation, is made up of presentative and representative elements, visual and tactile. When he feels

⁷² Mrs. Wood in the 7th month, Mrs. Hall in the 12th, mention expressly that objects are handled for a while before being lifted to the mouth.

⁷³ I do not find definite mention in other records of this period of conspicuous interest in investigating surfaces with fingers and soles; but my nephew, in the 9th month, has entered upon it quite as decidedly as my niece did.

it without seeing it, the visual representative element must be added to reproduce the complete object to his consciousness, no less than in the opposite case the touch representations.⁷⁴ The recognition of a known object by feeling only, then, is an interpretation, not a direct perception.

As early as the 14th month my niece could recognize my features by feeling them over in the dark. At two years old, and several times in the third year, I found her able to identify the several solid forms thus (I, pp. 70, 103). The experiments excited great pleasure in the child: it was especially interesting to her to identify an object by touch, then to look at it, thus comparing the testimony given by the different senses, and to a certain extent analyzing back into its elements the old synthesis of her earlier babyhood. I know of no other observation on the subject, but I have no doubt other children would show the same facility.

IV. MINOR DERMAL SENSES.

1. PAIN.

This sensibility remained low throughout the second year, at least; in the third, it increased, but still seemed less than in an adult. It is true that the severer hurts caused violent distress (so far, at least, as the vigor of the crying reaction is an indication). But the transitoriness of the distress was remarkable; up to the 20th month there was no sign of pain after its first infliction, though the injury of the skin remained. Even burns caused little discomfort after the first. The nerve ends seemed to recover normal condition with a rapidity impossible in the adult skin. Nevertheless, pains could not have been altogether forgotten, since caution was soon learned from bumps in the early creeping, standing, and walking; and the child was readily taught by a little gentle pricking not to desire scissors and the like.⁷⁵

Slight pains were easily subordinated by mental interest; thus in the 24th month, the child actually tried to make the dog

⁷⁴ The same thing was noted by Mrs. Hall and Mrs. Moore. tions are really tactile-motor ones, as all the visual ones are really visual-motor ones.

⁷⁵ The same thing was noted by Mrs. Hall and Mrs. Moore.

snap at her and graze her hand again, for the gratification of curiosity over the process (I, p. 149).⁷⁶ Indeed, the pain feeling in itself excited more than any other a curiosity, self-consciousness, and disposition to dramatize (second year). Its influence in defining the conception of self must have been great.

Pain perceptions seemed more subject to suggestion than any others (second year); but there was more effort on our part to bring them under control of suggestion.

I find practically no notes concerning pain in other records, beyond the few cited in footnotes; so far as they go, they are wholly in accord with mine.

2. TEMPERATURE.

I never saw in my niece any sensitiveness to atmospheric cold or heat such as adults feel very quickly; but extreme changes she would of course have felt. Local cold touches would no doubt have been felt at any time, but I have no note of it before the 17th month. The child did not at any time show the dislike to taking cold liquids into her mouth that some children do. A cooler temperature was enjoyed in the bath than seems to have been the case with Preyer's child;⁷⁷ I find no other reports of the temperature used in bathing.

⁷⁶ Tiedemann records that in the 5th month the least change made his son forget "even a toothache" (*op. cit.*, p. 24); Mrs. Beatty, that a visit to the kittens would stop the hardest cry over a bump or the like. Mrs. Hall's boy, in the 8th month, having accidentally hit himself with the handle of a brush, "with a force that made him wince, repeated the motion many times, wincing each time that he made it, although he did not succeed in hitting himself," *op. cit.*, p. 531; see also a similar experiment in pain on p. 534. Mrs. Tilley found that her second boy, in the 29th month, could not be diverted by pain from the forbidden pleasure of turning on water: "I have spatting one hand *very hard*, and while I was doing it he reached for the faucet with the other." See also Mrs. Moore, *op. cit.*, p. 81. My nephew, up to 9 months old, has seemed as indifferent as other infants to slight skin pains, so long as there is no element of shock; a really deep stab from a rose thorn he received in the 7th month with little concern, but cries readily at the slightest bump or blow.

⁷⁷ Preyer's child was bathed at first in water of 36° C.; in the 7th month, when the water was from 34 to 35, he always grew pale, as if from a shock to the circulation; he took pleasure in the bath, however, until it was lowered (the note is not dated) to 31¼, when he screamed uninterruptedly till the water was made warmer, and this seems to have been the case till the third

By the 20th month she discriminated moderate differences in temperature readily by the touch of the hand.⁷⁸ The temperature perceptions seem to appeal early to the child's attention, and to reach verbal expression, for no other descriptive adjectives are so uniformly early in appearance as hot and cold, warm and cool, in all the vocabularies in my hands.⁷⁹

V. TASTE AND SMELL.

1. TASTE.

Growth in Keeness of Sensibility.—The dullness of taste sensations in the early weeks of life has already been spoken of (pp. 37-8). Until the period of weaning, in the second half-year, there is little opportunity for the infant to develop or to display any finer sensibility. From the second month, my niece showed a certain surprise, or shock to habit, in experiencing a novel taste; and from the 5th month, on little tests, showed now and then pleasure in a taste. Other records⁸⁰ give instances of pleasure in some taste,—possibly depending only on the degree of sweetness. But on the whole, there is no indication that dur-

year (*op. cit.*, p. 115). My niece was bathed from birth in water of about $35\frac{1}{2}^{\circ}$ C. (96° F.); this was lowered within a few weeks to 34° C.; by the 6th month to 32° C.; by the middle of the second year, I find 31° C. noted as the regular temperature, and a reduction of this one day, by a chance failure of hot water, to $26\frac{1}{2}^{\circ}$, though it was not liked, was accepted without repugnance. The bath was always enjoyed, and never produced any but pleasant circulatory effects. So far as I know, the temperatures of her bath were such as are usual with American babies.

⁷⁸ Mrs. Cooley and Mrs. Tilley both note the same thing.

⁷⁹ To add a word on other dermal feelings:—

The few notes I can find on the subject show infants sensitive to tickling at whatever time the test is made; so in the 3d month, Tiedemann, Mrs. Tilley; 17th month, in my own notes. The feeling delighted my niece intensely at this date; in later childhood, it was disagreeable, as to almost all children.

Wetness and dryness were distinguished by the hand from the 19th month, and the concepts intelligently named.

⁸⁰ Tiedemann, Mrs. Tilley, Mrs. Helliwell. Sigismund, however, at the beginning of the 7th month, says: "The exercise of the sense of sight excites livelier pleasure than that of taste. The child still expresses no joy over good tastes." *Op. cit.*, p. 41.

ing the nursing period taste sensations are of much interest or importance to the child, as compared to other sense experiences.⁸¹

After weaning, children are sometimes reported as making difficulties about foods, refusing one and accepting another.⁸² There seems no reason for such discriminations, except taste preference. But it is not consistent and decided preference, and I cannot help thinking that there is some element of organic demand about it. When one food is rejected, and another preparation differing not materially in taste is accepted; when the same food is desired in one month, refused in another, and returned to in a third, as was the case over and over with my niece, (see dietary, I, pp. 230-234), it does not seem a question of taste preference proper. Nor was it a case of whim; the child did not refuse one thing in order to ask for another, but simply lost appetite and weight till some change was made; or, upon the addition of a new article of diet, appetite for others, which had flagged, would revive. Two instances only of real dislike for

⁸¹ The impression that the nursing shows a lively taste interest (Preyer, *op. cit.*, pp. 249-251) is no doubt due to the imperative *food* desire shown by babies from the first—which is not, however, evidence of taste enjoyment. The child's persistent habit of carrying things to the mouth has also had an influence. I have already, under the head of Tactile-Motor Associations, given an altogether different explanation of this habit. At the risk of pressing a point already clear enough, I here add some direct considerations against the taste-association theory.

1. The natural motor association of the nursing with food is not that of lifting the arm to the mouth, but of being put at the breast. From the first, the arm movement upward has been followed by the presence in the mouth of objects that gave the tactile-motor pleasure of sucking, but no taste pleasures.

2. If the infant had nevertheless some dim expectation of food, in carrying objects to his mouth, he would not go on day after day sucking inedible rattles and spools, but would show disappointment. Associations of pleasure do not persist when in the great majority of cases the action fails to yield the pleasure.

3. The infant does not treat the objects carried to his mouth as if they were food; there is no intentional swallowing; the object is instead mouthed and mumbled about over the delicate touch surfaces of lips and tongue, and especially is sucked.

Undoubtedly the ancestral association of the tactile surfaces at the mouth of the alimentary canal with the choice of food, is at the bottom of the whole habit; but that antedates the specialization of the taste sense itself.

⁸² Sigismund, Mrs. Moore.

any taste were noticed in the first year; almost any article of food while novel was liked.⁸³

Up to about the middle of the third year, indeed, while some tastes were greatly liked, none seemed to be much disliked; after this, the child became more discriminating, and many things were refused.

Taste desires were as a rule easily subordinated by other interests, and were quite readily inhibited. Curiosity and experimental interest connected with taste was slight. Nevertheless, from the 8th month up to the last quarter of the second year, great joy and desire were often displayed over tastes. How far my observation corresponds in this to that of others, I have not the data to judge.

Special Preferences.—Some of the special preferences recorded seem to me significant enough to be mentioned here. I found sweetness not especially liked before the 16th month. Milk seems never to have given much taste pleasure, and to have been desired in the nursing period mainly or altogether for the satisfaction of hunger. Clear salt seemed not to be perceived by taste at all up to the 9th month, but after this, especially in the 15th month, the child was passionately fond of it, preferring it to sugar,—a preference which I am not the only one to note.⁸⁴ The most consistent liking was for fruits, and here fruits of somewhat lively acid taste were preferred to the merely sweet ones; even clear lemon-juice was desired, from as early as the 9th month. Meat was liked next after fruit during a considerable part of the second year. Oily tastes, as of nuts and olives, were liked; and also strong ginger.⁸⁵

⁸³ "He often refused a food that had at first seemed agreeable to him." Mrs. Moore, *op. cit.*, p. 83.

⁸⁴ Mrs. Moore's son showed liking for saltiness in the 12th month. In the 18th month, "he liked salt greatly, and would have eaten it by the spoonful; sugar he refused to eat, but he liked to play with it. Throughout the second year he continued to like juice of oranges, grape fruits, or lemons (the last in lemon jelly), also apples and grapes. He did not care for sweets, but continued to demand salt." *Op. cit.*, p. 83. In the third year this child returned to liking for sugar. My nephew in the second half-year shows about equal liking for salt and for sugar.

⁸⁵ Mrs. Tilley and Mrs. Cooley record great liking for peppermint. There

Now these preferences certainly point to a somewhat dull sense of taste, desirous of strong stimulation. Older children are usually averse to strong flavors. It is true that my niece's preferences were all in themselves like the father's or the mother's, but neither of them would eat pure salt, or suck a lemon undiluted; nor would the child herself, after the second year. Indeed, from the third year there has been nothing unusual in any of her taste preferences.

2. SMELL.

I have said above that the early functional perfection of the smell apparatus, central and peripheral, and the unquestionable capacity of reaction to smell stimulus from the first, is hard to reconcile with the apparent absence of smell perceptions for many months. The proximate cause of this contradiction seems to be the failure of *active smelling* to develop, and the ultimate cause the declining importance of smell to the human race.⁸⁶

is really as much record of liking for such strong flavors to be found as of liking for sweetness; but I have no doubt this is because liking for sweetness was taken for granted. Still, when we consider also that apart from mere food desire there is usually indifference to milk, we must feel that Professor Preyer has rested too much upon the "sweetness of the mother's milk" as an explanation of the baby's choices, associations, and movements. I do not question, in face of all the independent evidence from all times of life, from language, from comparative physiology, that sweetness is really the most universally attractive taste; but rather that taste itself is developed to any keen sensitiveness in the early months of life.

I may mention as an additional evidence of the late development of discriminating attention to taste, that no vocabularies of two-year-old children show specific taste names. "Good," or some equivalent word of general approval (descriptive, as Professor Sully says, of the child's feeling about it, rather than of the quality itself), appears about the middle of the second year, as a rule; and a little later some word of disapproval.

⁸⁶ The links of cause and effect between ultimate and proximate cause can be traced back, in a negative way. Involuntary sniffing does not take place, to bring the stimulus to the olfactory nerve ends; even if it did, there is no reason to suppose that the sensation would excite hedonic impulses, and so lead to the repetition of the act, and the establishment of smell associations,—for there is no appearance of hedonic feeling connected with such smells as do, by their own diffusion or by artificial experiment, reach the nerve-ends. To go a step farther back, the sniffing movement does not take place automatically, because the ancestral paths are not well worn,

Yet smell does not altogether conform to the description of a disappearing sense, or a survival; as such, it should appear in the young infant, and fade out later. A complete study of its history among the primates might give us some light on its status in man.

My niece showed no sign of smell perceptions until the tenth month, and but doubtful indications thereafter. Like most children,⁸⁷ she was taught to sniff at flowers before the end of the first year, but if she really did manage to inhale the smell, she cared nothing for it, and made no distinction between flowers with and without perfume. At the end of the 18th month, she suddenly showed herself well able to recognize certain decided smells (wintergreen and camphor) and probably had been able for some time, but had showed no interest in the perceptions. It was not till the 33d month that she seemed really to find a smell disagreeable, uninfluenced by suggestion. (I, pp. 174-6).

Professor Preyer found evidence of true smell perceptions, on ordinary stimulation, from the end of the 15th month, and Dr. Garbini dates them from about the same period.⁸⁸ Other observers seem not to have seen such evidences at all within the first three years, but this was no doubt for lack of special attention to the matter.

Meanwhile, while the infant seems so obtuse to odors from without, which require inhalation, we must remember that he is probably experiencing more or less smell sensation through

so that jets of excess motor energy tend to them, as to the motor paths for the eye, the mouth, the neck, the arms. Thus, while the development of active sight and active touch is automatically initiated, that of active smell remains latent, with all the nervous apparatus ready.

⁸⁷ So in the records of Professor Preyer, Mrs. Beatty, Mrs. Tilley, Mrs. Daniels. The valuelessness of this sniffing for olfactory purposes is evident from the child's own ignorance of its meaning. My niece at first confused it with kissing, and would sniff at the picture she had been taught to kiss, and put a flower into her mouth. Preyer's child sometimes exhaled instead of inhaling, or put the flower into his mouth. Mrs. Daniels's daughter would sniff at any new colored object (14th month). Mrs. Tilley's boy, as late as the 24th month, had not learned to smell, and would put his mouth to the flowers. It is not from lack of effort to teach that these children failed to grasp the idea of smelling.

⁸⁸ *Evoluzione del Senso Olfattivo nella Infanzia*, p. 20.

the rear passages, from his food. Probably this happens from the first, in taking milk;⁸⁹ and that smell sensations are not only received but discriminated, is certain from the time a liking is shown for peppermint,⁹⁰ or other such substances, if we have made certain that it is really the characteristic flavor and not the sweetening that is liked. When meat broth is first enjoyed,⁹¹ smell sensations must be involved. However, the baby, like adults, does not distinguish sensations of smell received through the rear passages from those of taste, and no clear olfactory perceptions are formed.

VI. SENSES OF MUSCULAR ACTIVITY, MOTION, AND EQUILIBRIUM.

1. MUSCULAR ACTIVITY.

It is futile to trace the development of muscular feelings as a separate topic. In the advances of visual and tactile discrimination already spoken of, the real advance was as much in fineness of muscular feeling, and in its constant association with sensations of light and of contact, as in increasing sensibility to light and contact in themselves. In learning to stand, walk, climb, jump, and perform all the movements of bodily management, during the second half-year especially; in the acquirement of spoken language in the second half-year and thereafter (and for that matter, in the temporary use of sign-language, which is an important stage); in the acquirement of hand-skill, which is quite visible by the third year,—the muscular sensibility must develop steadily in fineness, and enter into most elaborate associative relationship with equilibrium feelings, with hearing, and with many complexes of sight and touch. But all this is familiar ground to analytic psychology: and any contribution that a record of observation could give to the subject would be nothing less than a history of the development of movement and of language.

In the infant's own consciousness, as in his visible behavior, the muscular sensations are no doubt lost in the complexes of which they are the uniting element. The release of the muscles

⁸⁹ Garbini, *op. cit.*, p. 18.

⁹⁰ Second month, Mrs. Tilley.

⁹¹ Eighth month in my observation.

from restraint was in my observation perhaps the earliest pleasure, and their free activity the greatest joy of the first year, if not of the first three years. It is scarcely possible, however, to separate the purely muscular pleasure from the diffused feelings of exhilaration coming from organic and vascular conditions. In the intense dislike to being caught or held, which I have fully related in my published notes (I, pp. 182-188), there was no doubt, as I have there suggested, more than mere sensory discomfort. In the joy of achievement shown by the child over the accomplishment of any muscular feat, also, we have to see more than mere sensory pleasure.

Yet the centers of muscular sensation, no doubt, like all other sensory centers, crave discharge by their appropriate stimulus, and experience a purely physical joy in the release of this tension.⁹² When a baby shows delight in a single act of muscular exertion (as in an instance cited by Tracy from Canfield, when a child in his 4th month held up his toy rabbit by the ears, crowing with pleasure; see also I, pp. 189-90, 192, for instances of the liking for a feeling of weight, or for pushing or pulling against an obstacle), we get very near to this primitive, simple muscular pleasure. When a baby experiments with his own body, trying new positions, getting comparatively unused muscles into action (I, p. 198, and scattered notices 324-96), the element of mere muscular enjoyment sometimes predominates greatly; the child is not trying to see how the attitude or movement in question looks, nor what it will serve for, but merely what he can do with his muscles. Much of the progress in locomotion came in my observation from such aimless muscular experimenting. The pure feeling of muscular activity seems to have been differentiated to consciousness most

⁹² How far the tension occurs in the sensory center of muscular feeling, and how far in the motor cells themselves, is a question for brain physiologists. At a guess, one would say in both; and that this enormous re-enforcement of central demand may be what makes the craving for action more imperative than the hunger for light or for sound, the joy in pure activity greater than that in the passive reception of any sensation can be, and the addition of the element of muscular sensation to any sensory complex necessary, before it becomes a source of great satisfaction to the child.

distinctly in any *novel* movement, and to have become neutral and indistinguishable (as with us) when the movement became familiar. So, too, the early use of the adjective "heavy"^{22a} shows that a sensation of *difficult* muscular exertion, the feeling of weight, is early recognized.

It is hardly necessary to fortify my own observations on such a subject with citations from any other records. Children evidently vary in the *degree* of their delight in muscular activity, and in the proportion it bears to passive sensory pleasures, or to intellectual activity; but not in the fact of it. There is also some variation as to preference for large and vigorous muscular exertion, as in running, shouting, and capering, or for fine and skilful use of the muscles, as in picking up and laying down tiny objects, corking and uncorking bottles, etc. In the former case, organic and equilibrium feelings enter largely into the pleasure; in the latter, more or less intellectual element. I have not data enough to make any intelligent comparative study of these differences in children; and indeed, it would carry me far beyond the limits of my subject.

2. PASSIVE MOTION.

During the first half-year I found the pleasure given the baby by passive motion greater than that of muscular activity; even when her face was covered, so that the motion feeling must have been quite unmixed, it pleased her (I, pp. 200-201). Later, this relation was reversed; still, throughout the whole period under review, to be swung, tossed, etc., was pleasing. During the early period, a monotonous jarring was more quieting than smooth motion; and later, especially from the 6th month on, sudden jolting caused merriment. I have observed in general that healthy children do not experience the unpleasant sensa-

^{22a} Tilley (older boy), 20th month; Gale (youngest child) and Shinn, 22d; Gale (second child), "before the 23d month"; Holden (both daughters), by the 24th month.

My niece used "hard" as an adverb as early as the 20th month, and both Mrs. Moore and Mrs. Price record it in the vocabulary at two years old, but I am doubtful whether it expressed consciousness of a feeling of muscular effort.

tions from jar that adults do, though unexpected jars frighten them. Yet children vary a good deal in this.⁹³

3. EQUILIBRIUM.

Feelings of equilibrium, present from the first, are most evident in the period of learning to stand and walk. All children show a consciousness of insecurity in balancing, before they have had any opportunity to learn fear by falls; and this "timidity" can be credited only to the disagreeable feeling of disturbed equilibrium. They all show delight, too, in achieving the feeling of secure balance.⁹⁴

My niece never showed any feeling of dizziness; nor have I found it reported in any record. Movement that would have made an adult dizzy was enjoyed (I, pp. 209-10). In later childhood,—at six or seven years old,—dizziness could be produced, but still was not felt as disagreeable; and this I think is the rule, with healthy children.⁹⁵

⁹³ Mrs. Tilley's and Mrs. Moore's children, in the 3d month, started and threw out the arms, cried out, or in other ways showed themselves startled, at a lurch or jar in driving, or in riding on the cars. My niece was quite without such sensitiveness to jar. Similar individual differences come out strongly in the acquirement of locomotion, when some children dread falling very much, and others are quite indifferent to it, unless actually hurt. Thus my niece, in the 10th month, while still unable to stand alone, would let go the chair she was holding for the pleasure of coming down sitting with a thud, and repeat the play over and over; and another little girl, daughter of Dr. Mary Stevens, of Detroit, enjoyed pulling a rocking-chair forward so as to let her sit down hard, and would appeal to her mother to help her up and let her do it again.

⁹⁴ Instances of unmistakable feeling of equilibrium disturbance in the newborn have been cited, on p. 42. During the early period of sense development, the painful feeling, like fear, when suddenly lowered, or when put into the bath, continues to appear in some children (see notes of Tiedemann, Mrs. Hall, Mrs. Moore, Mrs. Meade, Mrs. Tilley); but agreeable equilibrium feelings also appear in learning to hold the head and the back erect.

⁹⁵ To this chapter I may add that complex feelings of position, made up of muscular and equilibrium sensations, sensations of organic weight and skin pressure, and of vascular sensations, are to be observed in any baby, almost from the first. Fatigue readily makes itself apparent in connection with position; and before the infant can move himself at will, this is important to the nurse. Later, fatigue in one position is a powerful stimulus to the child in learning movement and the management of the body. The feeling

VII. ORGANIC SENSATIONS.

1. HUNGER.

It is hardly necessary to say that in every nursery, in the early period of sense development, hunger is a dominant sensation. It ranks only with pain in its insistence while present, and like pain, seems to disappear from the psychic field entirely the instant it is removed, leaving none of the memories, feelings, and desires that other sensations do.⁹⁶ I saw no disposition to take food except when hunger was actively present.

Yet even in the early months a strong sight impression could divert my niece from hunger,⁹⁷ while no effort could divert her during intense absorption in a sight impression. If hunger lasted long enough, however, to affect the general organic condition, through defective nutrition, the discomfort suspended every special sense interest (I, p. 217); on the other hand, the general sense conditions resulting from good nutrition were perhaps more productive of joy than any special pleasure, besides enhancing all special pleasures.

After the sixth month, as a rule, hunger ceased to have the imperative quality, and could be easily overshadowed by desire of seeing, hearing, and doing (I. pp. 221-3, 224-5). The organic effects of good nutrition were no less important than

of position, also, taken in connection with visual observation of his own body, must play a considerable part in developing clear somatic consciousness.

It is noteworthy that it was such a position complex of sensations that was first represented, and entered into associative relations, not any specialized sensation (p. 54).

⁹⁶ Yet the early psychic importance of the sensation is evident, since it was the basis of the first representation and association (p. 54, and note 95, above). The next visual recognition after that of a human face is the breast or nursing bottle (p. 68).

⁹⁷ So also in notes of Prof. Preyer, Mrs. Tilley, Mrs. Cooley, Mrs. Helliwell, and Mrs. Beatty. In the case of my nephew, who was born a thin and hungry baby (while my niece came into the world plump and well nourished), hunger was for several months most tyrannic, and his cries for food were like cries of pain; but as soon as good conditions of nutrition were established, and his weight up to a fair average, sight and sound impressions became more interesting than food to him also, and it was often hard to get him to attend to his bottle (3d quarter-year), and leave his play.

before; and the immediate sensation of satisfying hunger was sometimes, especially in the second year, a lively joy; but on the whole it was far from taking a leading place among the child's interests.

Individual differences are no doubt great here. It may be that a robust and tyrannical appetite shows active metabolism, and is a sign of vigor in the child; but my own observation tends rather to indicate that in a normally well nourished child, under normal conditions, the food craving by no means ranks as high in consciousness as the craving for muscular, visual, and auditory activity.^{97a}

Questions of how much, or how often, or what a child should be fed, to be "normally well nourished" belong to the province of dietetics, not to that of psychology.

2. THIRST.

That thirst is a remarkably strong craving during the whole period under consideration, every one knows who has ever tended a little child. After the milk diet ceases, the demand for water is enormous, and I noted no decrease in this up to the end of the third year. If the normal proportion of water in the infant's body at birth is about 75 per cent., and decreases very slowly from this to the adult proportion, 58½ per cent.,⁹⁸ while the evaporation due to the porous skin and constant activity is much greater in the little child, it is evident that thirst must be a perpetually recurring condition.

3. NAUSEA.

As Preyer observes, nausea does not accompany the regurgitation of milk in the early months. But after weaning it occurred several times, in my observation; once as early as the 10th month. By the 19th month, the child located the feeling fairly well.⁹⁹

^{97a} P. 221. See also "The Comparative Importance of the Senses in Infancy," M. W. Shinn, *Northwestern Monthly*, VIII, 9, April, 1898.

⁹⁸ Fehling, cited by Oppenheim, *The Development of the Child*, p. 13.

⁹⁹ I, p. 235.

A few words regarding choking, suffocation, and organic pain, will be found in I, pp. 235-6.

VIII. GENERAL SENSATION.

1. TEMPERAMENT.

Individual differences between babies are strongly marked, even from the first months, in the matter of the underlying sense condition of pleasantness or unpleasantness, equability or variability. This is quite evident in going over the different records in my hands, though it would not be possible to illustrate it without copious quotation.

In my niece's case, the undercurrent of feeling seems to have caused a stable cheerful condition, which reasserted itself quickly after disturbance by specific unpleasant impressions; during the first year, it often rose to great joyousness without definable cause, but this was somewhat less evident in the second and third year, as the increasing variety of specific pleasures absorbed the faculty of enjoyment into themselves, so to speak; and the child's temperament in later years was evidently one rather of equable cheerfulness than of the exuberant joyousness associated with the time of most rapid growth and development. In the case of some other infants, the underlying condition is evidently less stable, and yields even more readily to pleasant stimulus, giving a higher degree of joyous excitement, but is also very easily disturbed by unpleasant experience, and is more liable to after reverberations from joy or distress; this temperament is very evident, from the earliest months, in some of the records. In still others, an undercurrent of discomfort seems often present, even when it is not possible to find direct physical cause.¹⁰⁰ Nor do these differences depend on traceable differences in physical health; rather, one may conjecture, upon some condition of permeability in the organic nervous system, by which disturbances are more or less diffused, and therefore affect obscure organic conditions more or less. It is possible that these individual traits of temperament remain constant throughout life; I have seen some cases (where the infant temperament is on record, and accords with that of the mature person, as known to me), which indicate that they do; but I have no data to justify generalization.

¹⁰⁰ One cannot help being struck with the correspondence of these distinctions to the old empiric classification of temperaments as sanguine, mercurial, and melancholic.

2. MOODS.

Fluctuations in the baby's feeling of general well-being are noticed in all records. In my own, long waves of mood are apparent after the first year,—waves lasting for weeks or months, and but imperfectly traceable to any cause; and shorter waves, sometimes mere ebullitions of gayety or fits of peevishness, within these. The shorter moods were evidently connected with dentition; the appearance of a tooth was apt to be followed by an ebullition of gayety. I thought it probable that the longer periods had also some connection with dentition; but psychic conditions had more to do with them,—the child's growing desire for interest and occupation now outstripping her ability to provide it for herself and making her restless and exigent, and again opening up to her new fields of pleasure and activity, and ushering in a period of happiness (I, pp. 237-249).

I cannot follow these fluctuations in other records; but some variations in mood appear in all records as the result of obvious causes. The uniform effect of the bath (I, p. 249) in heightening the child's merriment, vigor of innervation, and even mental activity, is no doubt due to the freedom of the limbs, and the effect of the immersion upon circulatory conditions. Even more remarkable was the exhilarating effect of the open air, and other outdoor conditions (I, p. 250, *et seq.*),—an effect beyond what can easily be accounted for by the physical influence of the air, and any definite outdoor pleasures and occupations. Nothing in all the child's development tempts the observer so much to theories of vague ancestral reverberations, as the remarkable and overshadowing desire to get outdoors, and the endless contentment there, like the satisfying of some dominant instinct that is thwarted indoors. This may not be so conspicuously true in every case as in my niece's, but it is more or less evident in all records.

3. CONDITIONS ATTENDING SLEEP.

I found marked alterations in mood and emotion at the coming on and the going of sleep, which I could only attribute to vague and widely diffused changes in the sensory condition.

The well-known fretful condition of "sleepiness" was seen all through the first year, after the first month. This is not the sensation known to us as sleepiness, or drowsiness, and localized somewhat vaguely about the head and eyes; but a condition of general sensation more like ours in insomnia, when we have lost sleep, yet cannot experience a normal drowsiness; it appears in the baby, probably, because the time habit in going to sleep is not yet established, and drowsiness does not appear when it is due, although a general nervous fatigue has already set in (I, pp. 260-261).

From the middle of the 5th month, there was evident a strong resistance to sleep (I, pp. 272-8), which was at first plainly due to a desire to play; but later, by the 11th month, seemed to come from feelings of loneliness and timidity connected with the approach of sleep. From this date increasingly throughout the whole period under consideration, the disposition to confidence and affection, the sense of dependence, was peculiarly developed at bedtime (I, p. 278). This, I think, is frequently noticed.

Waking from sleep, when the sleep had been sufficient, was followed in the early months by a period of high good temper; but later there seemed a peculiar susceptibility at this time to feelings of timidity and loneliness, an unaccountable sort of distress (I, p. 279 *et seq.*). After the 7th month this was so marked that I was satisfied that some peculiar conditions of self-consciousness are associated with waking, probably a disturbance of the feeling of bodily identity and of relation to the external world,—feelings as yet but feebly established, and liable to confusion from alterations in cerebral circulation. Throughout the second year, and for some months in the third, this condition was often very noticeable, amounting sometimes to fits of wild crying and distress. It appeared also in the unaccountable crying at night that is called "night-terror" by medical writers,—not terror, it seems to me, but a peculiar diffused distress, which may easily be caused by feelings of lost identity, aided by the darkness. I have described it quite fully in the text of my notes (I, pp. 285-7), but I have no comparative material concerning it.

IX. RECAPITULATION.

I do not find that the data of Part III lend themselves well to tabulation. The developments recorded no longer proceed by a series of significant steps, as in Part II, but by long, unbroken processes, tending imperceptibly to a result. Thus a tabulation could only record growing clearness in visual definition for months, growing sensibility to pain, gradual acquirement of size and distance interpretations by an infinity of daily experiences; and so on. Such processes I can present most clearly in mere recapitulatory paragraphs.

I use my own observations as the basis of the statement, but I generalize and check them as far as possible by those of others, as in the recapitulation at the close of Part II. In cases where I have not had comparative data, the chronology of the summary will be liable to correction.

1. SENSORY CONDITION AT THE CLOSE OF THE PERIOD OF SYNTHESIS.¹⁰¹

Intensity and Differentiation of Sensations.—Great joy is experienced in the sight of motion, light and shade, but it is doubtful whether color vision yet exists. Visual definition is poor, and tactile delicacy in the hand undeveloped, so that no objects under perhaps an inch diameter are noticed or grasped. Visual adjustment is slow; the movements of people walking about are followed, but no smaller or quicker movements. There is no effort to handle objects (though some children investigate surfaces), and the hand is used only to carry them to the mouth.

Sounds are heard fairly well, and somewhat differentiated; music affects the child agreeably, and sometimes suggests a responsive cooing; the human voice is in a general way discriminated from other sounds, though individual voices are not recognized; extremes of pitch and marked differences in quality of tone have in some cases a strong affective quality; even spoken syllables are now and then noticed as pleasing or amusing.

Sensations of pain, of diffused temperature, and of taste are dull; but instances do appear of likes and dislikes in taste. Active smelling does not appear, and if any smell sensations are

¹⁰¹ About the beginning of the 6th month.

received it is through the rear nasal passages, undistinguished from taste.

Feelings of muscular activity give pleasure, still more those of passive motion; a monotonous jarring is especially soothing. Some children in the early months are distressed by sudden changes in motion, and very sensitive to equilibrium disturbance; others scarcely at all.

The hunger-thirst feeling is imperative in quality, yet easily suspended by appeals to eye and ear. Diffused conditions of general comfort and discomfort are strongly felt.

Recognitions and Interpretations.—Outlines are traced by the eye, and objects are beginning to be identified, by eye and hand. The practical difference between seizable bodies and plane figures is just coming to attention, and associating itself with their differences in appearance.

Direction and position, within the visual field, are well enough systematized. Distance has some measurement by accommodation movements, by the arm-reach, and by passive movement to and fro; but its relation to changes in apparent size, or to the advance and retreat of bodies, is not understood. Beyond the visual field space relations are conceived only through the most fragmentary and crude inferences from experience.

Sound is well associated with the expectation of sight; and when near by and in the horizontal plane of the ear, or when familiar to experience, with the visual direction. The processes of producing sound begin to interest.

There is fair somatic consciousness of face and hands, and a rough knowledge of the rest of the body.

2. SIXTH MONTH.

A sort of transition period; the fusion of hand and eye consciousness is in progress, and the new type of experience not yet fairly established. Instead of systematized conceptions of lines of movement in space, we get glimpses of the crudest empiric expectation that bodies will appear here or there; and solidity is still only seizability. The use of the hand as a touch organ is increasing, however. The promptness of visual adjustment

is greater; the hand movements of others are closely watched, and much thus learned of direction and position in space; the movement of falling bodies attracts attention at about this stage.

There is an increase of tactile sensibility all over the body, and the control over it and acquaintance with its surface increase greatly.

There are efforts at locomotion, and motor enjoyment increases. I saw beginning in this month a delight in lively jolting and tossing about.

3. SECOND HALF-YEAR.

Intensity and Differentiation of Sensations.—Reactions to color, at least to the long-wave colors, become unmistakable. The eye adjustments continue to grow quicker, but probably remain slower than those of an adult. The delicacy of visual definition and the tactile delicacy of the fingers increase steadily, till in the 8th–11th months the minutest objects are noticed, picked up and fingered.

From the 7th month the supremacy in touch has plainly passed over to the hand, and by the end of the year the mouth is only resorted to to supplement hand-investigation; in the 8th–10th months the forefinger tip is specialized for minute investigations.

Pain sensibility remains low, and hurts have remarkably transitory effect.

Hearing grows more alert, and there is less liability to auditory shock. Enjoyment of music continues, but is not often intense, and only the most precociously musical children acquire the least mastery of rhythm or pitch within the year. The differentiation of sounds to the ear increases wonderfully.

With the adoption of more varied food after weaning, more taste interest appears; sometimes great pleasure in tastes, but I saw no decided dislikes. Indications of smell are most doubtful.

Feelings of muscular activity enter into fine relation with equilibrium sensations in acquiring balance and locomotion. Passive motion is now less enjoyed than active. Sensations of dizziness are not experienced.

Hunger and thirst are differentiated after weaning, and thirst

becomes frequent and intense. Hunger is at times imperative, yet is even more easily suspended by interests of the intellectual senses than in the first half-year. Nausea has been observed by the 10th month. General sensation still supplies dominant under-currents of feeling.

Recognitions and Interpretations.—With the acquirement of creeping, which is usual in this half-year, the infant ranges to and fro, handling everything, and rectifying his ideas of distance, size, direction, and position; by the end of the year all these spatial relations must be seen and conceived much as they are by ourselves, and well estimated for a space about the child at least equal to an ordinary room. From the 11th month outline pictures are recognized and suggest the object represented, and in the 12th month a simple plane figure can be readily discriminated and known by name. Solidity is probably perceived as we perceive it, but there is no attention to solid form, and the knowledge of it must be of the slightest.

The fine differentiations made in the hearing of verbal sounds are interpreted with singular precocity, and spoken words begin to be understood usually about the 7th month (in some cases even earlier), and by the end of the year a good deal of speech is understood. Individual voices are recognized and referred to the proper speakers about the 8th month, but few other sounds to their respective sources within the first year. The origin of sounds is investigated curiously through the whole half-year, and intelligent experiments in sound have been reported, 9th–11th months. Sounds in the horizontal plane are more and more perfectly referred to the proper direction, and there is a slow improvement in locating sound above that plane.

With the larger control over the body, and much investigation of its surface and trying of its powers, the extension of somatic consciousness is great. Conditions of diffused discomfort and timidity at the approach and end of sleep suggest a disturbance of general sensation, with confusion of somatic consciousness, and more or less loss of the still unstable feelings of personal identity, and relation to the exterior world.

4. THIRD HALF-YEAR.

Very early in the second year (13th month) consciousness of light and dark appears in language, but no one has been able to find comprehension of any color concept before the 16th month, nor of any except red before the 17th; about the 18th, color associations appear. Visual discrimination for outlines, however, becomes remarkably fine, as good as that of any untrained adult. Features are recognized in the smallest photographs; letters and characters are learned with the greatest ease and spontaneity (12th–16th months). Pictures, oftener strong outline pictures than colored ones, are of great interest from this half-year on.

Interest in the origin and interpretation of sounds remains lively, and most sounds now come to be referred to their respective sources.

Well developed smell perceptions, discriminated and recognized, appear in the latter part of this half-year (15th–18th months).

5. FOURTH HALF-YEAR.

In this half-year some children can learn to distinguish and name all the colors, as well as any adult; probably they see them as if somewhat less saturated. All the plane figures are easily taught at this time, well understood and generalized. The child when taught color and plane form becomes very observant of them in the world about him. Solid form is taught with difficulty, and does not lead to spontaneous interest.

A few children in this half-year can keep time to music, recognize an air, give a note or interval correctly, or even sing a fragment of an air. Some who cannot, sing spontaneously in a rude chant. Sounds coming in vertical direction are located with more difficulty than an adult experiences; but the direction is accurately caught in the horizontal plane, even if the sound is a distant one; and distant sounds are distinguished from near ones. When perplexed by an unaccounted-for sound, as an echo, the child shows confusion as to the nature of sound, perhaps tending to conceive it as visible or tangible.

Taste pleasure is sometimes lively, but decided choices are not shown. Taste excites little curiosity, and taste desires are easily

inhibited, in some cases, at least, where the habit of inhibition is formed.

Temperature differences, and wetness and dryness, are well discriminated by the hand early in the half-year.

The subordination of pain by mental interests increases throughout the whole second year; yet the sensation is not quite so transitory in the latter part of the year as before. It makes a peculiarly vivid impression on the mind in the form of curiosity and a dramatizing, self-conscious interest, which appears to be closely related to a developing clearness of the somatic consciousness.

A hint of the completeness reached by that consciousness by the fourth half-year is given, in the correct location of the feeling of nausea (19th). The features and members of the body are easily named by children by the end of the second year, as well as the acts of seeing, and later of hearing.

6. THIRD YEAR.

Children who have not yet come to a complete knowledge of the color concepts always prove able to do so in the first half of the third year. Solid form is still not very interesting, but can readily be taught. The space around the child to which systematized ideas of distance and size have extended is very much larger,—perhaps a mile, but this depends on his experience of walking and driving about.

Musical development advances slowly, and some children now first become able to keep time, take a note, etc.; but probably in average cases there is but the rudiment of this before the fourth year. Primitive spontaneous chanting is sometimes quite highly developed. Rhymes and jingles please by their rhythm.

Taste is more discriminating, dislikes more apparent. The child becomes able to distinguish and name all his sense impressions. There is little sense development left to record; apart from the common musical deficiency, and some errors in interpretation through inexperience, the child even at the entrance on the third year has practically the same senses as an adult, and it is the intellectual development based on their report that henceforth demands the observer's attention.

7. COMPARATIVE IMPORTANCE OF THE SENSES.

There is one more recapitulatory word to be said, and it bears not only on this Part III, but on the whole history of sense development from birth: It is worth while to notice the comparative part played by the senses in the infant's psychic life; the demand made upon his attention and interest by the higher and lower groups of sense experiences respectively.

An observer's first impression of a young baby is that in the intervals of sleep he lives only in the sensations connected with food,—hunger and taste. It is easy to think of him as living (vegetating, even Professor Sully says) in a neutral and scarcely conscious comfort, varied only with the liveliest sensibility to hunger, or at intervals, to pain, and but dim sensibility of any other sort, unless it be taste. I cannot make my observations agree with this conception, though I started out with it.

It is true that hunger and pain have in the infant, as they have in us, a quality of imperativeness that can subordinate everything else. But they have this quality in no higher degree in the first month than in adult life. Moreover, in the case of a healthy, well-fed baby, hunger rarely passes the stage of appetite, and there is no occasion for serious pain; and as these sensations, entering little into association complexes, are hard to bring back into consciousness in the form of memories, desires, and fears, the total share of the baby's attention occupied by them is small.

On the contrary, an incessant stream of visual and tactile and muscular and auditory sensation flows into his consciousness during his waking hours. And such sensations are by no means neutral ones. I have already remarked that my niece showed in the first two months more enthusiasm over such visual matters as, for instance, a spot of light vibrating on the ceiling, than she ever showed over food in the first eight months, and quite as much distress over being obliged to lie down when she wished to sit up as she ever did over hunger. The records of others brim with similar evidence.

This relation between the satisfactions of the higher and lower senses holds no less after the child is older, and taste interest has been developed. Children show a keen delight in tastes, but

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on the whole not as much, in proportion to other interests, as many adults. The whole apparatus of refined cookery and the production of delicacies, which take up so large a part of the energies of society, are in answer to the desires of adults; indeed, it is largely by living under food conditions fixed by these adult desires that the child develops taste interest. The greediest child, in normal health and activity, does not give as much of his thought to what he eats, or find as much of his happiness in it, as many men of middle life do. The child's prime interest is in his *play*. It was the rule that my niece would rather play than eat, even when she was hungry; and this is a frequent observation in every nursery.

So, also, the interest in play—that is, in the use of the higher sense powers and bodily and mental activities—may constantly be used to divert a child from pain; while the effort to divert him from any play he is set upon by pain is apt to be as futile as in the instance given by Mrs. Tilley of her attempts to keep her boy from turning on the water (p. 200, note).

In a word, the doctrine which has somewhere been formulated, that the infant's conscious life begins with the lowest senses and develops upward toward the higher ones, is wholly contrary to observation. On the contrary, the more extensive the psychic complexes into which a sense enters, by so much the more, from the very first, it leads in the baby's attention,—and in his enjoyment, save only for that delight that comes from a diffused condition of general sensory well-being.

NOTE.—Observations on my nephew, too late to be cited even as a footnote on the proper page, lead me to doubt my generalization that the human voice does not seem to the infant to need accounting for by any movement or impact of objects. This boy shows (end of third quarter-year) persistent curiosity over sounds from our lips, putting up his fingers to investigate, as if seeking a tangible origin for the sound. He is a child given to noise-making manipulation of objects, but not to vocal experiment, and shows little consciousness of his own muscular activities. The converse was the case with my niece. It is therefore quite possible that sound proceeding from human self-activity would early seem normal to the one child, and not to the other.

PART IV. PEDAGOGICAL RESULTS.

The pedagogical results of this study have been to a considerable extent foreshadowed in the course of the preceding record and discussions. They do not formulate themselves into any systematic scheme of sense-education (indeed one of the things that seems to show itself forth most plainly is that nature herself will attend to that in the main); but into a few general principles, which apply really to the education of the little child in all lines quite as much as to his specific sense-training, and a few special suggestions, such as my own observation and study of other records has led to. Sundry others might be made, by other observers; but these are all that are justified here.

In looking back over the whole course of development for the three years, to see where and how the guiding hand of the elder was able to affect it for good, it may be seen to fall quite distinctly into three periods. The first is that before the acquirement of grasping, a period in which the child's senses have not yet come into working order, for lack of cerebral interconnections, and nature must be let alone in completing the sense apparatus by the maturing of the central paths. The second is that period of vigorous eye and hand investigation which follows upon the acquirement of grasping, and in this the parent needs sometimes to lend a helping hand, to give the natural processes their full scope. The third, arising out of the second by imperceptible degrees, and not formally distinguishable from it by any date, is that in which the parent may wisely begin some gentle bending of the formative processes toward the desired goal of education in civilized life.

1. EARLIEST STAGE: BEFORE GRASPING.

Spontaneous Development.—The most constant impression left upon the observer after watching the development of the senses in an infant must be that of irresistible natural processes, which it is impossible to help or hinder to any considerable extent. Suggestions concerning the possibility of accustoming the child

from birth to forms, colors, and motions, presented in orderly succession, fall utterly to pieces before the spectacle of the gradual upbuilding, the knitting together of primitive sensory elements into real powers of perception. Any moderately lighted room into which a baby can be put affords it the material for acquiring vision, and one set of inanimate objects is about as good as another.

The Human Presence.—One thing only seems to be of indispensable value educationally. That is the coming and going of the human face; perhaps (after the first month or two at least) of two or three different faces, with their associations with different voices, different arms to be held in, agreeable experiences of food, and movement, and play.

Nothing in all the infant's environment educates it as does the human presence. In the earliest days of seeing, when nothing is noticed but illumination, the grouped high lights on the face hold the attention with a peculiar interest, and by their fixed relation to each other form the earliest visual association group. The human face bends down and comes to the range of clear vision before the baby is able to adjust his visual focus to objects at varying distances; he acquires accommodation first in following it as it withdraws, and his focus is led on farther and farther in watching people as they come and go. He acquires his conceptions of distance and size and direction mainly by this same road. By learning to recognize his friends when their faces are turned away he first comes to an understanding of the identity of objects in their different visual aspects. When he begins to use touch also to investigate objects, nothing attracts his curiosity oftener than the faces of his attendants, which he explores with hands and mouth in every possible way. By the association of voices with the face, he gets his first auditory idea of direction. The face is the first visual object recognized; the voice the first sound, unless, it may be, instrumental music. From his perceptions of the different effect when he touches another person and himself, from his observation of the same movements, unfelt in them and felt in himself, comes the final re-enforcement of his bodily self-consciousness.

. Of the further intellectual and social education that comes to him through human association, I do not speak here. But even in the matter of sense development only, the human environment is the one thing of importance.

. Here nature herself has provided the best education. The mother, bending over the child with constant care, with instinctive prattle and gentle touch, is bringing the senses into effective co-operation, organizing the whole association system, more swiftly and surely than any possible system of forms and motions displayed before his uncomprehending eyes, could do. All the mother's foolish instinctive play with the baby, the rolling over, kissing, cuddling, cooing, ducking her head into his bosom, her songs and lullabies, the baby's unchecked liberties with her face and hair, are giving him the best possible material for intelligent use of his senses. It is a matter of easy observation that the baby who is left lying on the bed alone a great deal, no matter how well cared for physically, does not develop as brightly, and learn to use his senses happily as soon, as the baby that is cooed over and played with.

2. SECOND STAGE: VISION AND MANIPULATION.

Provision of Stimulus.—With the development of grasping comes a period at which the natural environment is not sufficient to meet the needs of the expanding faculties; or, to put it more truly (and most literally), the child is not able without help to get at and lay hold on his natural environment. The helplessness of the human infant,—necessary as it is to his ultimate high development,—compels him to sit waiting to have the due food of mind and body brought to him. If the baby is to come to grasping, he must be supplied things to grasp. It is true that he will learn in any case,—the folds of his clothes, the fingers of his attendants, will answer for material. But with material so insufficient in variety and convenience, grasping will not pass through its normal stages of development; it will come as a "deferred instinct," all at once, when the full time has arrived. In that case, the movement will be acquired, it is true, but the lessons in space perception, the slow and sure fusion of

eye and hand knowledge, the educational value of the more gradual development, are impaired; they have to be learned in belated fashion afterward, if we may judge from the blundering and insecurity that is shown in the grasping for a long time, as if the associative network between the cerebral centers were insufficient (p. 112, and Preyer, *op. cit.*, p. 249).

Most mothers are neglectful of providing soon enough the objects for grasping. It is taken for granted that children do not need playthings till they can play with them, which is much like keeping them from the water till they can swim. Indeed, in many a home one may see babies, otherwise tenderly cared for, sitting with nothing in their hands or within their reach, fretful for lack of occupation, long after they have learned (by meagre chance opportunities) to grasp, and every moment is precious for the manipulations and mouthings their senses are craving.

The appearance of successful efforts to carry the hands to the mouth, the fumbling of the fingers on a surface that they touch, the closing of the hand with a newly firm and conscious hold on objects laid in it,—these are the indications (appearing about the third month) that grasping, with its immeasurable psychic results, is at hand, and the baby ready for material to practice on.

But it is still futile to think of education through any system of presenting the spectrum colors and the geometric forms as playthings. It is not certain that the child even sees the colors, especially the cold colors, at this date; it is certain that he does not attend to and discriminate them, and that he cares little for them. The difference between the several solid forms is not easily perceived, even far on in the second year. In the early period of grasping, the simplest sensory feeling of solidity, probably even of objectivity, is yet in the forming, and the difference between sphere and parallelopipedon is merely a question of which is easiest to lay hold on and get into the mouth. The brightness of an object (not its color); the rattle or jingle that can be obtained from it (for sound-making processes already interest); its resistance, weight, and movability; its identity in all its different visual and tactile presentations; the mere fact

of its solidity, its extension in space between the surfaces on either side which he touches and sees; the difference between an object thus seizable, and a plane figure; the nature of the surface, smooth or rough, hard or soft,—these are the things the baby must be occupied with for many months, before he can comprehend form or color. The important thing, therefore, is that the objects given him shall be convenient to grasp and to suck, shall offer a good firm resisting surface for him to feel against his palm and gums, and, shall be such as he cannot harm himself with. Some jingling or rattling adjunct for the ear, some bright silver or nickel adornment, or black and white contrast, a good cylindrical grasping place for the hand, a convenient tip for sucking, meet all needs well enough.¹

From this time, the more fully every desire of the baby's to touch, feel, pull about, and mouth everything he can lay hold on, can be gratified, the better. The best educated baby will be the one kept in an environment where there is least that can injure him or that he can injure, and allowed to investigate to his heart's content. The wisest mothers even give the baby much that he could injure or be injured by, and then keep vigilant guard, rather than check his inquiry. It is mainly a question of how much trouble the mother is willing to take for the baby's good. Is willing, I say, not is able, for I have not observed that the busiest mothers are the ones who find it hardest to take the time for this attention to their babies.

Restriction of Stimulus.—At this stage of the child's development a danger becomes serious, which exists even earlier,—from the time a baby can first be played with and entertained at all.

¹ These are easy requirements. A silver spoon, a few empty black and white spools or large wooden or bone beads strung on a strong tape, a bit of bamboo with sliding rings, any slender shaft of smooth wood with a good conical end—such things are better than nine out of ten of the elaborate rattles offered in the stores. I am not convinced that the baby really cares for the rattling adjuncts; he seems to prefer getting sound by pounding objects on the table, or banging them against each other, and he has always a sound-making organ superior to any in his own throat, and by these other methods he can observe the sound-making process better than by shaking a rattle. However, I am not prepared to criticize the practice of all times and races in the matter of the rattle, and it does no possible harm.

That is the danger of over-crowding stimuli upon his attention. One must draw the line between neglecting to provide needed stimulus, and over-stimulating. It is by no means a difficult or delicate line to observe in practice, for it is perfectly easy to see when a healthy, normal baby is being over-stimulated. Indeed, at this age, a baby will himself draw the line, and only folly in the parent will coax him over it. As soon as his attention is called from object to object, before he has exhausted the interest to be found in each,—as soon as he is confused by the number of objects of interest, and distracted from one to the other, he is going over the limit of his mental good. It is a good old nursery rule never to divert the attention of a baby who is occupied in looking at or playing with anything, lest his power of attention be weakened. Babies suffer on the one hand from the sheer selfishness of those about them, who recklessly make playthings of them and break into their self-activity; and on the other hand from the sheer neglect that fails to provide them material and opportunity for self-activity. This neglect commonly befalls infants who are cared for by servants, however faithful and prudent.

The secret of happy and wholesome development in the early years seems to be mainly in giving the largest possibility of free action. Nothing is more conspicuous in my record than this. The remarkable hatred of restraint; the intense joy in free activity; the busy energy with which when left to herself the child would pursue her own education,—all show nature, up to a certain point, doing better with the development of senses, muscle, and mind than any outsider could do, and requiring only such help as the baby's own helplessness in laying hold on material made necessary. And to secure to a child the largest freedom of activity possible is by no means easy and simple, for it is a different thing from simply letting him run, uncared for; it sometimes involves much more trouble than restricting him narrowly; he must be companioned, co-operated with, "lived with," incessantly. But the results are worth it.

3. THIRD STAGE: BEGINNING OF INSTRUCTION.

Limitation of Purely Natural Development.—Up to a certain point, I said above, nature can do all that is necessary, if opportunity and material are provided. But the time comes, gradually throughout the second and third year, when nature alone is not sufficient. It should be evident that the instinctive unfolding of the child's powers will go no further than to put him into possession of those race traits that have become firmly infixed in us by long ages of inheritance. Even when it comes to so old an acquisition of the race as speech, the baby will not acquire it by pure self-unfolding, as he acquires seeing and hearing and grasping; he must learn it by imitation. When it comes to the attainments of civilization, even imitation is not enough. Tasks must be set, and efforts must be made.

Bearing of the Recapitulation Theory.—A smattering of the recapitulation theory leads mothers (and, unfortunately, physicians, who approach the subject from a physiological rather than a psychological point of view) to set down the child as "only a little animal" during the early years of his life, and in no need of human education.

One is quite misled by the ontogenic and phylogenic parallel, if one supposes the senses or the mind of a baby are really those of a lower animal. He comes into the world with an apparatus of sense and of intelligence that have long before birth diverged from the pre-human type. It is undeveloped, but not of low order. The infant's brain at birth, for instance, according to Donaldson, has its full number of cells. It has, as Flechsig shows, the same sense-centers, the same vast and elaborate system of sensory and motor and association paths, specialized to the same purposes, the same great tracts of association or "intellectual" centers, as an adult, and such as the most intelligent of the lower animals does not remotely approximate. The cells and neurons are simply unripe, not yet in function. They come into function roughly in the order of their racial antiquity, and therefore in an order that repeats roughly the phylogenic. But the order is broken into in a thousand ways; and at best, the parallel is only a parallel, not an identity. From the first, a

purely intellectual sort of impulse makes its way into the baby's processes, and makes them unlike those of the lower animals.

Compare the behavior of Dr. Kinnaman's monkeys toward color with that of a baby who might be supposed to be at about the same general stage in the development series. The monkeys were perfectly able to discriminate all the colors, but they had not the slightest interest in doing so until their dinner depended on it. Mrs. Tilley's baby boy, in his 15th month, seeing a blue dress thrown on a lounge, toddled up to it, and panted and smiled with pure excitement and joy over the sense experience,—an experience that had for him no relation to any life-preserving activity. Many lower animals show as much intelligence as a baby in the second year; but in how different a spirit! Can any one imagine a dog bringing a letter on a block with interrogative grunts, wishing to have it named and ticketed off among his apperception groups? or an elephant puzzling himself over the damping of a sound when a hand is laid upon a glass that a spoon is tapping? An immense excess energy, over and above life-preserving needs, and flowing into the development of the great human associative centers, makes the infant's cerebral action of a type utterly unlike the lower animal's, even though it follows in some sort along a parallel line in the obvious stages of development.

It is on this excess energy that education builds. In this lies the possibility of catching up, so to speak, by cross cuts, with thousands of years of race attainment. The child must make these cross cuts, if he is to become a civilized man; if he is to become a highly civilized one, he must make them with the least possible waste of time and energy. As soon, therefore, as the rapid development of the association centers begins (comparatively plastic as their order of development is, not rigidly fixed by primeval inheritance), the problem of education begins, in directing that development. Even if the child were actually a lower animal or a savage, he could not wholly dispense with lessons. The very cat teaches her kittens, with every appearance of purpose, with cuffs and rewards,—as any one may see who will watch her awhile; and the parent birds hurry on their nest-

lings with lessons into the instinctive activity of flying. Much more should the human mother refuse to be frightened by pedagogic theorists out of teaching her nestling its little lessons, such as in her opinion will best prepare the way for the mastery of the great accumulations of the world's knowledge. She herself, with her close intimacy with the child, is the best judge of the extent and content of the lessons; she needs only to start with the full assurance that in calling the mind into guided action, instead of "letting it run wild" she is doing the normal thing.

Limits of Instruction.—It is but in the slightest degree that any formal education can be begun, within the first three years. For the most part, all that has been said of the second period holds good in the third. The largest freedom of activity possible, is still the rule,—the child's own self-chosen play, watched over and cautiously aided, without too much suggestion, or too much apparatus. It still remains true (as indeed in all later education) that the Scylla and Charybdis between which one must steer are the danger of breaking up and shallowing the attention through urging it with rapid and changing stimuli, and the enfeebling it through insufficient demand. The danger is never especially great of overtaxing the mind,—vigorous exertion and normal fatigue is as wholesome for brain as for body,—but of fatiguing it by frittering its powers and pulling it this way and that; amusement and excitement, provided from the outside, so to speak, and not obtained by the child's own exertion, are more dangerous and exhausting than a quiet, steady mental tension.

Along the lines of his own choosing, a child even in the second year will show a good deal of capacity of mental tension. By watching him, all through the second and third year, experimenting along the lines of his own interest, being wary meanwhile of any very firmly formulated theory of infant education, but well possessed by high ideals of the future education toward which these first steps are to tend, the mother can accomplish by gentle degrees, and with real enhancement to the happiness of the little one, a wonderful deal toward starting him well on the long road of formal education.

Special Suggestions.—In the few unsystematized suggestions that follow (let me repeat), there is no attempt at anything like a scheme or system of sense-training; nor any attempt to cover the whole ground. They may perhaps be taken in the light rather of illustrations of the sort of educational beginnings that may wisely be made, feeling one's way along the lines indicated by the general principles that precede. I set them down in chronological order.

1. The earliest direct sense training which the mother will attempt is in most cases that of the ear for the enjoyment of music. Indeed, this may in a sense date far back of the "third period," to which I have assigned the beginning of deliberate sense education, for music gives the baby a simple sensory pleasure from the first month of life. Results from hearing it, in the way of musical development, are much later, and vary greatly with different children. In all cases, however, something is learned of rhythm and pitch, and the habit of enjoying music is formed.

The teaching of rhymes and jingles, in the latter part of the second year and during the third, is a good adjunct in the teaching of rhythm. Now and then a child is found who can catch simple dance movements within the second or third year.

2. At some time not far from the close of the third quarter-year, the child becomes capable of enjoying pictures, and of relating them in his mind, in some fashion, to the objects represented. It is a highly educational pleasure, and the child should have it as soon as he is able to use it. As the time approaches when he could be expected to care for pictures, they should be supplied, but not especially urged or explained; and he will do the rest. It is possible for injudicious parents to do harm by amusing themselves with showing the little one pictures in great number and rapid succession. A few familiar pictures, well looked at, over and over, each one as long as the baby will (no matter how bored the parent may become) are far more educating than many new ones hastily looked at. The parent should watch the child and introduce new material slowly, from time to time, as she judges it can be taken up into the mental life

without confusion. The child will to some extent regulate this himself, refusing to take interest in novelties that he is not yet ready for, and going back to the same old pictures; but it is possible to break down this wholesome condition in him, and teach him to crave new sights perpetually.

Looking at pictures belongs especially to the second year, and will probably prove an occupation of much (though intermittent) interest, throughout the whole of the year. Most of the evidence is to the effect that clear black and white outline is more satisfactory than color, but let both be tried, by all means. The possibilities of real systematic education that lie in the selection of subjects,—the acquaintance with animals, with domestic life, processes of labor,—will occur to every parent. If acquaintance with the picture can be followed up regularly by the sight of the object itself, the educational effect is much greater. This however, carries us beyond the subject of mere sight-training.

3. The ability to recognize all the simple plane figures is certainly present by the middle of the second year, and if language development is advanced to the average degree, the child may easily be taught to distinguish them by name. They may be taught him by pencil-drawing, by stick-laying, by clipping out paper forms, or by use of the cardboard tablets found in kindergarten supply establishments. It is not a bad idea to use all these methods, and so help the child to generalize the form idea. If my experience is typical, it is worth while to teach these figures, for the sake of the lively attention it awakens to varieties of form in the world of surrounding objects.

4. There is no difficulty at all at this stage in teaching those particular plane forms that make up our alphabet, and the Arabic figures. It is a striking tribute to the influence of Rousseau that a curious and unfounded reluctance to allow the child to learn this particular set of names has become widespread, displacing the old practice of our grandparents. The child, playing with his letter-blocks, is often curious to know the names of the symbols, and in any case picks them up with great ease if he is taught,—for he is in the very heart of the nascent period in learning to attach auditory symbols to visual objects; later,

the attainment costs him more difficulty, and is more tedious to him. It is a great convenience to later teaching if the baby can pick up a good part of his alphabet during the second year, in the course of play with blocks or cards, and I am satisfied that no mother need have the faintest scruple in teaching them.

5. The discrimination of colors, down to distinctions as fine as any adult would make, can be taught sometimes in the latter half of the second year, always by the first half of the third year,—not with as much ease as plane figures, but still without great trouble. It is by no means necessary to use such elaborate and laborious methods as in Professor Preyer's experiments and mine, since we were trying to get statistical results; a little care taken to show colors and name them a few times to the child would probably be sufficient. But the child may perhaps find it easier to get the different color categories clearly defined, and to assign difficult intermediate tints rightly, if standard colors are used in teaching, instead of any colored objects that chance to be at hand.

When he is able to learn the colors in the second year, it is a better time than the third; for during the nascent period of name-learning, the simple exercise of attaching its name to each color delights him, while in the third year, when the interests are more complex, it is apt to bore him. This, of course, depends much on the degree of advancement in language. I found that familiarity with colors opened up to the child a source of great pleasure in observing color in the world about her (just as in the case of the plane figures), and the effort of the attainment seemed amply justified by this.

6. The solid forms can be taught, without costing the child any real difficulty, at perhaps two years old or in the third year; but they do not rouse much spontaneous interest. The indifference to them, and the confusion shown in understanding their properties and their relation to planes, throws much doubt on the wisdom of making them an important keynote of sense education. Certainly they cannot be utilized much in the first three years. If it is intended, however, that the child shall enter kindergarten at three years old, and shall be taught during the

next period of life on kindergarten lines, there can be no harm at all in introducing some simple knowledge of these forms in the third year, by way of leading up to the kindergarten course.

As to the pedagogy of the other senses, I have little to say. No doubt both taste and smell could be trained to greater discrimination, but there seems no reason why it should be done. The inhibition of irregular desires is rather the way in which taste training should tend, and so far as I have seen, children show very quickly the effect of such training. The education of the muscular sense that is given in connection with motor training; the remarkable pedagogic possibilities connected with the peculiar states of general sensation and then of emotional susceptibility in the borderlands of sleep; the several lines of early teaching that lead the child to more complete definition of the bodily self,—these all belong more conspicuously to other subjects than to that of the Senses. For anything more that concerns the pedagogy of the unspecialized senses, I will only say that all observations point to the largest possible outdoor freedom of bodily activity, with good health, as the condition of a felicitous state of organic and general sensation, and all the fortunate results in temperament and healthy emotional experience that follow thereupon. To secure to the child this large freedom, under the very best conditions of vigilant companionship, means lavish devotion of the mother's time and care.

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UNIVERSITY OF CALIFORNIA STUDIES

NOTES ON THE DEVELOPMENT OF A CHILD PARTS III and IV

BY

MILICENT WASHBURN SHINN, PH. D.

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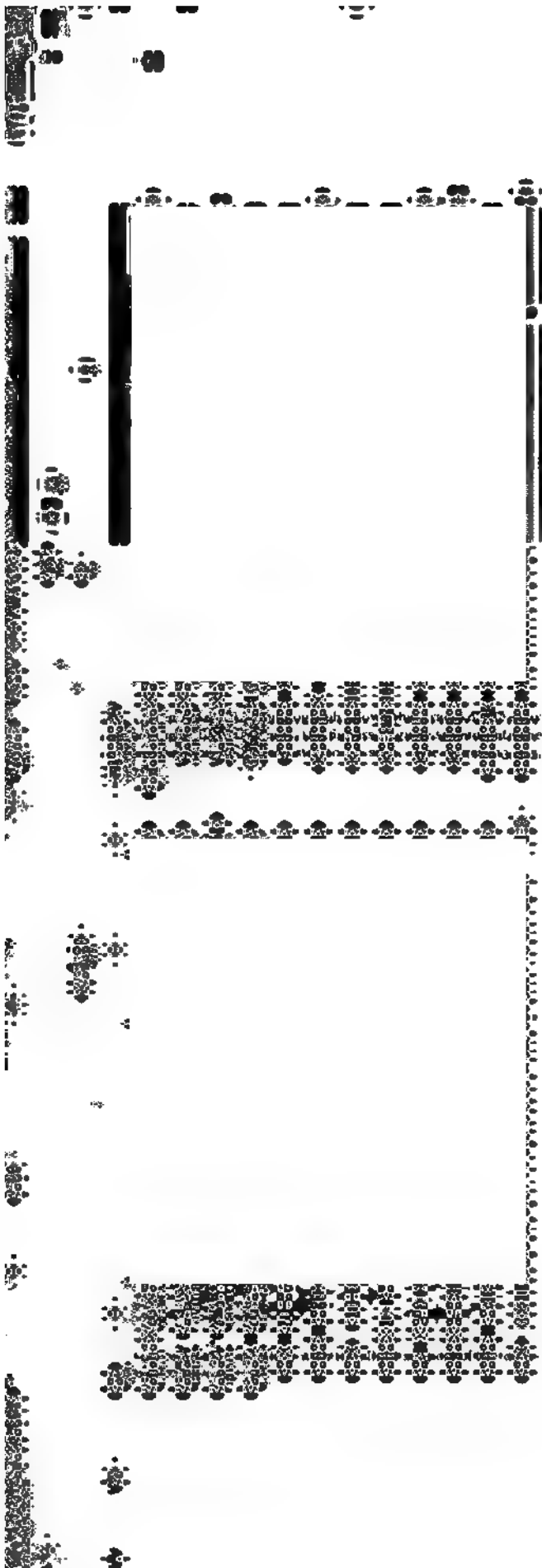
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7th month.—One of the earliest stages in the development of creeping, the mere habit of various positions propped up on the hands and knees, is well shown here. See pages 333, 407, 414

One year old.—The ease and freedom of this position in standing (a spontaneous one, frequently taken at the time), will give some idea of the development in security of balance. I have no satisfactory photograph of the standing position entirely unsupported, which was completely acquired by this date.

Numbers III and IV of the *Notes on the Development of a Child* are published through the kind liberality of Mrs. Phœbe A. Hearst

SENSATIONS OF MUSCULAR ACTIVITY, MOTION, AND POSITION.

THE sensations here grouped, (quite various in their physiological origin, but too closely interwoven in the development of the child to be separated in the record,) are among the most important of the first and second year. This is evident, not only from the remarkable extent to which the pleasures of this period are made up of motion, active and passive, but also from the numerous and complex muscular adjustments that are acquired, impossible without the guidance of sensation. Directing the eyes, seizing and handling objects, walking, talking, are examples. But the greater part of the account of these sensations is inseparably involved in that of the movements, and cannot well be given here. The notes that follow, therefore, are but the incomplete record of this group of sensations that can be detached from my later notes on movement, and give but an inadequate impression of their importance.

1. Muscular Sensation.

We have no positive evidence of the presence of muscular sensation until the appearance of voluntary movements requiring its guidance; still, it is reasonable to suppose that it accompanies movement from the first; and the earliest, unregulated movements may be of considerable service in developing it and differentiating it in the consciousness, till it is able to take its part in directing voluntary movement. Thus sneezing and crying from the first hour, and afterwards sucking, starting, winking, smiling, hiccoughing, yawning, stretching, panting, and varied vocal exercises, gave quite a wide experience of muscular sensation during the first two months. Still more efficient in this direction must have been the aimless movements called by Preyer "impulsive," since these were remarkably profuse and continuous during the first weeks. From the first hour the arms moved quite freely, say three or four inches: and on the 4th day the nurse, trying to trace the baby's hand on paper, found that even in sleep she would not let it be held still, and kept the fingers sprawled. On the 5th day I noticed that when

she was awake and comfortable, her head was much of the time moving vaguely from side to side; so constantly, indeed, were the head and eyes moved during the first month, that so late as the 29th day, I could not, in repeated trials, tell whether the eyes really followed a moving object for a few inches, or only moved with it by chance. Violent grimacing was also frequent (this, however, not entirely without peripheral stimulus, as it seemed connected with faint sensations of discomfort); and arm and leg movements were practically continuous when the baby was wide awake and comfortable.

These irregular movements disappeared¹ with the appearance of more voluntary and co-ordinated ones, as if inhibited by them. Even staring, in the third week, tended to inhibit the grimacing and the aimless movements of eyes and head; and with the acquirement of fixation (4th — 8th weeks: see *Sight*, pp. 14, 15), and of ability to stiffen the neck, turn the head at will, and balance it (3d — 10th weeks) they disappeared; I have no note of them after the first month. The first co-ordinated leg-movements I saw the baby use, — propping herself with her knees when laid on her face, — were on the 32d day; and during the next week, when held out in one's lap along the knees, she began to push strongly with her feet against the body of the person who held her, and when in the bath, against the foot of the tub: simultaneously, the aimless leg-movements disappeared, and are noted but once afterward. Arm-movements of the primitive type continued longer, through the second month, increasing in freedom ("waving," and "brandishing" arms are the words I find in my notes): but within a week after the first appearance of any voluntary arm-movement (a little tugging on her mother's hands when her arms were held up in wiping her after the bath), they had ceased to be continuous: she would lie perfectly quiet half an hour at a time, looking about her. Vigorous movements of arms and legs were common enough after this: but they were of a different type, either expressions of joy and excitement or, in my judgment, voluntarily made for pleasure in the muscular activity.

¹A few isolated instances of movements that might be classed with this type occurred later, and are noted under other heads.

Such motor adjustments as showed the directing power of sensation were thus present in the eye-muscles by the 25th day, and in quite complete degree by the eighth week; in the neck muscles by the third week, and in quite complete degree by the tenth. There must have been an advanced degree of voluntary control in the tongue and lips by the seventh week, as the baby at this time experimented deliberately with them (see Feeling, p. 136); and these and the rest of the vocal organs had come under control sufficiently for experimenting with sounds by the fourth month. In the leg muscles, whether the guidance of sensation was necessary or not for such simple acts (possibly reflex) as propping with the knees, or pushing against a resisting surface, which began with the second month, it certainly seemed present in the skilful kicking that appeared in the latter part of the third month. The trunk muscles must have co-operated in the propping and pushing movements of the legs; and though these very simple contractions may not have needed the guidance of sensation, it must have been involved in the repeated efforts to straighten up the body in the first week of the third month (see Movement). In the arms, its guidance first appeared on the 47th day, and was habitual (in efforts to carry the hand to the mouth) by the first week of the third month. In neither legs, arms, nor trunk, did skill of movement reach any advanced stage within the first year. In the fingers, it was still later: the first attempts at grasping extended through the fifth month, while small objects, as a single hair, were not handled till the latter part of the eighth month; and even in the second and third years finger skill was very limited.¹

¹ The order here is: Eye, neck, tongue and lips, trunk and arms, legs, vocal organs in general, fingers. It is evident, however, that the use of arms and fingers must needs wait on that of eyes, since grasping is quite a complex act, in which sight, touch, and muscle sense must co-operate; that legs and trunk must come into co-operation before any but the simplest action is possible for either; while the vocal organs have co-operations with each other to acquire before much advance in their use is possible. It would be hasty to say that after these preliminary co-operations are once acquired, the order of progress in muscular control might not differ considerably from the order in which it was first established. As a matter of fact, however, I am quite convinced, from later observations, that the eye does keep its lead, while the vocal organs come rapidly to the front at the time of

The most abundant evidence of the existence and importance of the muscular sensations, (except that afforded by the growth of skill in action), was the remarkable pleasure experienced in the exercise of the muscles, and the dislike of all muscular restraint.

The striking satisfaction experienced in liberation from clothes, I put down as due to relief from this restraint; though there probably was also a considerable feeling of rest in the cessation of continuous touch sensations on the skin; and there may have been an increased freedom of circulation, though the baby's garments were carefully planned to avoid all constriction. From the first month (my note fails to show just how early) the expression of satisfaction in the baby's face when she was being undressed for the bath, or laid naked on her mother's knees, was noticeable. In the tenth week I note that undressing and the bath give as much satisfaction as food; and in the fifteenth week that undressing (with the bath or rubbing that followed) is next to seeing faces and being played with among her chief joys, — calling out not the vivacious expressions that the social pleasures did, but an indescribable look of felicity, with opened mouth and eager gaze at her mother's face, and only occasional vigorous kicking. By the sixth month it made her very gay, and I find many notes such as "when undressed, went into a shower of gurgles," or "laughed abundantly." In some cases, being undressed and rubbed changed her mood, leaving her happy and sunny, after she had been fretful all the afternoon.

During the period in the third and fourth months when she was persistently eager to sit up, fretting inconsolably when laid down under ordinary conditions, she was still content and often hilarious if laid down naked, or even with legs free. In the fourth and fifth months, she was often laid in the sun (her head shaded) with her

acquiring speech, passing the trunk and limbs in development; and that the fingers remain in the rear for years. I will just suggest here the pedagogic significance of this observation, — its bearing, for instance, on the question whether reading should precede hand training, so far as the question is one of muscular conditions, — hoping to recur to it later, with fuller material for its consideration. As to the bearing on the formula that the development of muscular control proceeds from essential to subsidiary muscles, or, as sometimes quoted, from central to peripheral muscles, it is to be said that discussions of this formula have not attempted to take into account the head, neck, and face muscles.

legs thus free, and would lie in high spirits, kicking, crowing, gurgling, smiling, and chewing the rubber of her rattle, for twenty minutes at a time: a few instances of similar jubilant behavior when she was laid down without the legs free, are noted, but it was unusual. In the ninth month she was several times allowed to creep about on very hot days in diaper and shirt, and it gave her singular delight; still more when she was allowed to creep naked. In the second year during the winter months (fifteenth to seventeenth) she was undressed on the hearth-rug, and several times allowed to caper about it unclad: it gave her great delight, but she soon tried to escape and scamper about the room. This she was allowed to do on several very warm days of the following summer (eighteenth to twenty-first months) after she was undressed, or in her nightgown, — which came to much the same thing, as she held it up high enough to free her legs completely. Her joy in this emancipation was remarkable, — running back and forth, squealing, shouting, gurgling, flinging herself down and jumping up, in an ecstasy of freedom. Once in the eighteenth month it was impossible to get her to leave the interesting occupation of climbing up and down stairs for the sake of dinner, and she had to be carried to the table forcibly; yet when after dinner she had returned with zeal to the climbing, she instantly deserted it, laughing and eager, at the suggestion that if she would come and be undressed she might run around in her nightgown. Next afternoon she began to ask for the same indulgence, and cried pitifully with disappointment (a most unusual thing with her) when it was not considered warm enough; and she did not give it up as usual, but renewed the request in the evening. Although she was as a rule intensely unwilling to come in from outdoors, she came in cheerfully once, in the latter part of the twenty-second month, on the promise that she might run round in her nightgown.

With the third year, the release from clothes ceased to cause such an abandon of joy; twice in the twenty-fifth month I note that she asked prettily when undressed, "May Ruth run round little bit?" and scampered about, trying to work herself up to the expected hilarity, and laughing not altogether spontaneously: still, she enjoyed it much, and nearly cried when she had to stop. After this she either ceased to seek the privilege, or the colder weather

drought it to an end; I have no farther note of it. She continued more or less disposed to "rampage" in her bath, however, or on her mother's bed when undressed, instead of getting into her own crib, — a common enough observation with little children, — as if the release from clothes acted as a stimulant to activity.¹

The converse feeling of dislike to being dressed, appears a little later in my notes. By the middle of the second month complaints under the process are noted. By the fourth month this was the main source of displeasure in the child's existence; she almost always whimpered over it, and if she was tired or hungry it caused wails and tears. Sleeves were a special grievance, and in the thirty-seventh week if I was near by when her mother came to this part of the process, the baby would reach her arms to me in appeal for rescue. Up to the time that she had learned the connection of cloak and cap with going outdoors (late in the seventh month) she complained when they were put on. In her baby-carriage she was usually unwilling to keep her hands under cover. By the last week of the eleventh month her dislike of dressing had declined, and as a rule she would lie unconcernedly across one's knee and let herself be dressed; after the twelfth month, I find no note at all of whimpering over it. By the twenty-second month, however, she became very averse to keeping her cap on outdoors, wished her head free, and pulled the cap off constantly; her coat too she disliked and would twitch at, saying, "Ruth don't need have coat!" (She is to the present writing — at seven years old — very much disposed to get hat and coat off outdoors, though she has no dislike whatever to clothes in general.) In the twenty-sixth month, when she was sleeping in my charge for a time, I used to muffle her up in a comforter in the morning while I went to prepare her bath, as it was impossible to keep her lying in bed: she detested this, and

¹ The mere novelty of playing without clothes no doubt helped to stimulate excitement (as the loss in excitement in the twenty-fifth month goes to show): but scarcely in the first year; nor even in the second and third was it enough to account for all the exhilaration shown. Even adults are aware sometimes of a quite remarkable sense of relief and heightening of energy in disrobing or putting on freer and lighter clothes. That there is real muscular restraint in clothes is evident from the necessity athletes find of stripping as much as possible before exercise.

it took some firmness to prevent her throwing off the wrappings, however cold it might be; on one occasion I came back and found her sitting obediently, still swathed to the chin, but in tears.

One of the earliest signs of anger I ever detected in the baby, — a tone of temper in crying, — was on occasion of an extra dressing one day, at eleven months old; and thereafter whenever she cried over being dressed there was the same slight tone of temper. There quickly appeared now a resentment against muscular restraint of any sort: to be held still in order to have her clothes arranged, to be kept fastened in her high chair or nursery chair when she wished to get away, caused angry crying and efforts to escape, — almost the only signs of temper she ever showed at this period. In the thirteenth month, if she was taken or held against her wish, she would either stiffen and wriggle away, or lift her arms and become limp, so that she slipped through one's grasp. I note squealing, stiffening, and wriggling, in protest against being taken or held, as late as the nineteenth month, and it is my impression that it lasted considerably longer; in the eighteenth month, she would *twist* herself away from an annoying hold. She never cared much to be held in arms; rarely would consent to sit long in any one's lap; and after getting the use of her own legs, almost never asked to be taken or carried. After she was a year and a half old I find constant notes of her reluctance to be carried, held, or even led. In the twentieth month she would cry, "Ruth walk!" or "Own self!" if lifted in arms, and pull away her hand, crying, "No!" if one tried to lead her; she pushed away my hand when I held her dress as she climbed a risky place (or, the next month, as she swung in the hammock). In the twenty-first month, as at a year old, though she never showed real passion, restraint could make her cross for a few minutes, and restraint only: she would squirm and scold to get away, to be allowed to get down from her chair, to go out of a room. "Let Ruth go!", "Let Ruth down!", "Don't!" she would scold. "Staking out," that she might play about safely without much watching, an admirable device with some babies, proved impracticable with her: except in one instance, when she was so occupied that she perhaps did not discover she was tied, she would immediately find the end of her tether and be driven to despair. In the twenty-seventh month she was very fond of "playing catch,"

and would coax her uncle into it, making sallies and calling him strenuously: she did not mind being caught occasionally, but objected greatly to being held, and if he did not release her at once would first cry, "Let me go!" then appeal, "Aunty, come help me! Uncle Joe did *catch* me!" with a most aggrieved air. In the twenty-eighth month, when her grandmother once held her tight to prevent her running into some danger, she became much displeased, told her to "go away," and refused to kiss her for many minutes, which was unusual resentment for her sunny temperament.

After this, she became more willing to be carried, or to sit on our laps, but I still find notes of appeals to be put down, and as late as the thirty-fifth month, she reported to me that she had "s'appèd damma," angry at being taken from the bath and held still to check her capering till she could be wiped.

Even the mere *suggestion* of restraint, a caress or touch, sometimes annoyed her keenly in the second year. In the eighteenth month, her mother's hands laid on the back of her chair annoyed her; she put up her own hand, and pushed first one and then the other away, saying, "'Way!" and in the twentieth, pushed mine off with the uncivil remark, "Ta' bi' ha' 'way" — Take big hands away. So again in the twenty-third month. In the twentieth month she seemed annoyed at caresses, did not want a face or hand too near her, and would push it away saying, "Take head away!" "Take hand away!" The day she was twenty months old her father came in as she was undressed, and took her foot in his hand. "Papa, don't touch Ruth foot!" she cried: "don't touch Ruth foot! don't touch baby foot!" "Don't kiss hand!" "Don't eat [kiss] Ruth neck!" "Don't kiss Ruth, — hurts!" are noted on one day in the twenty-first month; a few days later I kissed her hand when she was already squirming to get away from her father's hold, and she fairly snarled, "*Don't!*" snatching her hand away. In the twenty-second month, she tumbled about happily half an hour on my bed, listening to Mother Goose rhymes and wishing me to lie near her, but utterly refused to let me put an arm about her or touch her, saying crossly, "Don't!" — "Don't what?" — "Put arm on Ruth back," — *i. e.*, around her. She would sometimes give caresses herself, but wished to be left free to retreat on the instant: so in the twenty-fourth month, lying beside me, she would roll up and kiss me gayly, then away again. It was some-

thing like a half-tamed kitten that will offer caresses, but springs away with fear of being caught if you lay your hand on it: but in the child's case there was no sign of *fear*, only repugnance. With the close of the second year this feeling about caresses ceased to be noticeable. In the last week of the year, having coaxed me to lie down on the floor by her, she wished me close to her, and stowed herself in my arms, across my breast or head, face against mine, repeatedly kissing; and at intervals during the third year, when sleeping beside me, she liked to creep over into my bed and go to sleep in my arms; "Lie *c'ose* to me, au'tee," she would say. She was, however, considerably less clinging by daylight than in the dark.

Late in the twenty-eighth month she made great resistance to having a poultice put on her finger, running away and crying, "No, mamma, *no*!" After some reasoning, she submitted to the substitute of a glove-finger and salve, and kept it on all day. Such whims were not frequent with her; and the only interpretation I could make of her vague but strong dread, was that it was connected with her repugnance to being in any way bound.

From about the middle of the seventeenth month, "Caught! caught!" was her cry, to express the distressing feeling of being impeded, or held, as when wedged in a narrow space between wall and chair, or when her dress caught and held her back. Fastened in her high chair (the first day of the eighteenth month) she struggled to get out, crying, "Cau'! cau'!" She would cry, "Cau'!" if held in our arms when she wished to go free; if two chairs were too near together to allow her to pass between them easily, she would complain, "Cau'!", as soon as she found she would have to squeeze to get through; or if any twig or vine tangled about her feet, the same cry came, — sometimes when the impediment was absurdly small, a mere suggestion of hindrance, as when a forked seed-vessel of *Martynia* hooked itself about her leg. In the nineteenth month she cried when side-garters were first put on, pulling at them and saying, "Cau'! cau'!" and "Off!" when she felt the slight tension, as she moved. Once in the twenty-first month she climbed up on the lower rail of a fence, and after trying in vain to get up to the next one, complained, "Ruth caught, — little foot caught!" though nothing but gravitation impeded the little foot.

The first sign of imaginative sympathy she showed was for this grievance of restraint, when she tried to lift away the branch from a picture of a lamb caught in briers (twenty-fifth month, see Sight, p. 104). In the twenty-seventh month she nearly cried over a picture of an opossum holding a bird in his mouth, — not because the bird might be hurt or killed, but because it was held: "Mamma, that little bird *can't get away!*" she said pitifully. In the twenty-eighth month she saw a photograph of the well-known Faun and Child, and asked in a troubled tone if the child could not get down; and again, coming to some pictures of papooses in their cases, "Can't the baby get out?" Of a child in a bed whose covers were fastened down, "That baby caught! He can't get out! That baby tied!" Up to this date, her pity had never (with a single exception) been excited by picture or story for any grievance save this one of physical restraint.

There was no doubt more in this curiously strong dread of being caught, held, impeded, than mere discomfort in the restraint of muscular activity. Some of it might be attributed to a more general desire of freedom, though this particular child did not otherwise show much passion for the free exercise of her will, yielding it rather easily as a rule. There was often something curiously unreasoning and instinctive in manner in the repugnance she showed to physical restraint, which suggested remote inheritance, savage or even pre-human. In other manifestations, as the dislike to hands on her chair, or the exclamation, "That *Ruth* foot!" there seemed a glimpse of a sensitive defense of personality (something quite different from mere assertion of will) that was strangely mature, and in advance of her general stage of development.

Enjoyment of active muscular exercise for its own sake did not appear very early. I saw no instance of it till late in the third month,¹ when the baby, lying naked in her mother's lap, would kick out her legs with a new motion, quite unlike the former vague motions, straight and strong, with as much precision as if she were

¹ But see under Movements (below) one or two instances of a curious jerking and turning of the head in the last week of the second month; and also note the pushing with the feet in the second and third months.

performing a gymnastic exercise, and with every appearance of enjoyment. This hilarious kicking was very common thereafter for several months, till creeping was acquired, in the ninth month. It was always quite different from the demonstrations with legs and arms that expressed joy and excitement: I was satisfied that it was done purely for the pleasure of the sensation. In the third month also, 86th day, I noticed that when holding her rattle and flourishing her arms she no longer flourished the other arm, and I thought the movement was now deliberate, for pleasure in brandishing the rattle.

In the fourth month began the making of various sounds for amusement, in which the pleasure must have been as much in the muscular sensation as the noises; this continued through the next month, and was recurred to at intervals during the whole period under consideration. In the fourteenth week, it amused the baby much to sneeze, and she always ended with a bright smile. "Playing" with objects began in the fourth month, also, — at first merely fumbling with rattles and other easily handled things, moving them about and putting them to the mouth: then more complex hand occupations (such as tearing paper to bits in the sixth month, thumping the piano in the eighth, rocking the sewing machine pedal or pulling things out of a basket in the ninth; rocking chairs, raising and shutting lids, pulling doors to and fro, digging in the dirt, waving good-by, shaking hands, in the last quarter of the year; and a multitude of more and more complicated acts in the second and third years). In all these there was a certain element of muscular pleasure, though obscure.

From the first day of the fifth month I note splashing in the bath, also a complex pleasure, with an element of muscular sensation. In the same month, I began to see instances of especial pleasure in exercising muscle against resistance.¹ The baby used to take firmly between her jaws a stout rubber strip attached to her rattle, and twitch it out with a jerk, getting of course a double sensation,

¹ There may have been some such liking in the pushing with her feet horizontally in the second month (p. 180), and in the downward pushing, "feeling her feet," that preceded walking movements; but it is more likely that these were involuntary responses to pressure on the soles, connected with the undeveloped instinct to stand and walk. Mrs. Beatty's boy (see p. 135, above), on the 16th day, pushed so strongly against the foot of his basket that he nearly pushed himself out of it.

in arms and in jaws. Perhaps a similar muscular pleasure was originally the motive of a persistent habit, dating from the first week of this month, — that of tugging at her father's and grandfather's whiskers, which they somewhat fatuously encouraged. At the end of the sixth month, grasping being now fully established, she became most eager to pull, with laughter and exultant clamor, at the nose, ear, and especially the hair, of any one that held her. In the seventh and eighth months, she not only assailed her mother and me thus, but had romps of the sort with several young girls of the neighborhood, who liked to get down on the hearth rug beside her and surrender their bangs to the rollicking little thing. We had soon to check the habit, but in the latter part of the tenth month, and through the eleventh, I note seizing and pulling hair as a trait of rough frolics. From the seventh month on, there was from time to time shown a curiously intense desire to get hold of and tug at the hair of the dog, the cat's fur, even the fur of a rug; pulling the dog's ears and tail was inveterate at times. How far all this was a case of a general liking to use muscular effort against a resistance, I could form no judgment. From the time grasping was acquired, there often seemed a special satisfaction in pulling at a fastened object, more than in obtaining possession of a free one. In the twelfth month the baby was given a bit of tough steak to suck, but found more pleasure in tearing it with her jaws, much as she had pulled at the strip of rubber in the fifth month.

With the latter half of the first year came a period of peculiar pleasure in the movements of her body, connected with the acquisition of the main race-movements, — rolling, creeping, standing, walking. In some cases, the acquisition of these movements was sought very seriously, merely as a means to an end, and in others appeared accidental or almost automatic; but in still others, it was attended with great joy in the exercise (see *Movements*, below). On the whole, as her power over her body increased, her chief joy came to be in the free use of her muscles. Thus it is my constant note during the seventh and eighth months that she lay kicking and rolling about the floor, or on a blanket spread on veranda or lawn, perfectly happy by the hour, sometimes breaking into cries and movements of joy. In the eighth month if one carried her about in the arms, she refused to be entertained by any efforts, and leaned

over and looked wistfully at the ground or floor, to indicate her wish to be put down and left to the freedom of her own movements. The kicking (p. 188) at this time was of an extraordinary vigor: she would raise both feet as high as she could and bring them down with the utmost force: it seemed unaccountable that it did not bruise her heels badly, but she appeared to take the greatest delight in the exercise. For several days in the latter part of the eighth month, instead of this kicking, she would sometimes hold her legs up perpendicularly for several seconds.¹ By the middle of the ninth month, the rolling and kicking were succeeded by a sort of varied scrambling about the floor, — sitting up and lying down, kneeling, creeping, etc.; then in the next three months standing up and sitting down and some beginnings of walking were added. During these months I constantly note her delight in being turned loose on the floor, or better yet the lawn, where she would tumble about at will with frequent shouts, crows, and babble of joy.

Sundry minor exhibitions of pleasure in the use of her muscles were noted in this second half-year. In the twenty-ninth week, she practiced grimacing and sniffing for some days, in evident gayety; in the thirty-first, when her mother put her hand under her head to support it in the bath, she would begin to stiffen and throw her body, resting on her feet and her mother's hand. In the thirty-third week, when she was taken under the arms and swung out, she would lift up her body and legs and straighten her back by sheer muscle (getting help of course from the motion with which she was swung) till she was horizontal, or even till her feet were higher than her head, and would keep the position a second or two. In the same week she lifted with her left hand a valise that weighed four pounds, and held it about ten seconds; then several times immediately afterward lifted it again and held it for four or five seconds. The feeling of weight on her arms seemed agreeable. In the eleventh month she took the greatest delight in the newly acquired accomplishment of nodding, and for several days bobbed her head and shoulders diligently.

¹ In the same month, Preyer's child had the habit of holding up his legs vertically, but with somewhat different behavior; he was interested in the sight of his feet, and grasped at them, while my niece seemed interested only in the muscular exercise, and learned to grasp at her feet and carry her toes to her mouth under other conditions.

In one way and another throughout the first year her movement was almost incessant, and any occasional period of sitting quietly (as once in the twenty-sixth week for an hour in church) is noted as unusual.

With the second year came a period in which, the main race-movements being now acquired, occupations of a more mental sort came to the front, and pictures, language, sights, exploring and satisfying curiosity, overshadowed the simple muscular activities. Many of these more complex occupations, however, involved a great deal of muscular action, so that the child was still perpetually in movement; and in some it was hard to find much motive beyond that of using her muscles. The liking for a feeling of weight mentioned above was an example. In the thirteenth month, when first walking, she liked to carry about a weight, doll or book, merely for the sake of carrying it, and the fancy recurred at intervals throughout the year. At the beginning of the seventeenth month she lifted a rubber bag of water that weighed seven pounds; in the eighteenth month she took up a seven-pound flat-iron in one hand and walked off with it; in the twentieth, she picked up a two-pound dumb-bell in each hand, held them a few seconds, and then dropped them. In the nineteenth month, finding a pile of pamphlets in a waste-basket, she carried twelve, one at a time, into the next room to me; and in the twenty-second month she carried fifteen sticks of wood, in like manner, from one pile to another. Here, too, may be mentioned the pleasure the child experienced in suspending her own weight by her hands. In the seventeenth month I tried lifting her by a stick held in her hands.¹ When she understood the idea and was supplied a stick that fitted her hands, she enjoyed it greatly, laughed aloud all the time she hung from the stick, and was eager to do it over and over. Each time, her hands relaxed suddenly, and she fell, with an expression of dismay; but was very eager to renew the exercise. In a few days she took an aversion to it and refused to repeat it, but with no appearance of fear. In the twenty-third month she returned to it and took pleasure in hanging for a few

¹Darwinism in the Nursery. Dr. Louis Robinson, *Popular Science Monthly*, vol. 40, p. 674.

seconds; and again in the twenty-seventh month. (From her fourth year on, the child has been supplied with a simple apparatus — a rope and stick — to swing from, and has had much pleasure in it; and by the sixth year she was bold and skilful in swinging from the branches of trees.) In the twenty-first month, finding two chairs in the middle of the veranda, she pushed one to the extreme west end of the veranda, turning the corner of the house, then turned the chair about and pushed it back around two corners to the extreme east end; then remarking, "Get another chair," brought the other likewise, — a distance in all of about 250 feet, over a stone-paved floor.

By the latter half of the second year the higher development and variety of the bodily movements now attained, had once more made them a source of very considerable pleasure in themselves, apart from the mental interests they opened up; as will be more fully reported under the head of Movements. By the end of the year, however, the free running and walking, jumping, climbing, etc., had ceased to be so much enjoyed for their own sakes, and mental interests again distinctly overshadowed muscular pleasure.

Ebullitions of the liveliest frisking, racing, jumping, shouting, with intense desire for motion and noise, are noted from time to time (especially in the twenty-first month); it seemed impossible, up to the third year, for the child to sit without an occupation, simply looking about. All this exuberant action was doubtless in part a mere spontaneous discharge of energy, the expression of a high general well-being, and in part an indulgence in muscular action for the pleasure of the sensation it afforded.

Though she had been from very early a "romping baby," fond of rough play, the romping of the first year had necessarily been of a sort in which she was rather passive (as being tossed or danced); but by the fourteenth month, she began to find the joy of active romping. In the fifty-eighth week, she frolicked with the dog, running at him with laughter. The sixty-fifth week she discovered the charm of "playing catch" around tables and chairs, with hilarious glee. No doubt the pleasure was partly in the dramatic element of the play (two days later, *e. g.*, she laughed herself weak when quietly playing hide and seek behind the furniture,

and could not tire of it); but that an intense muscular pleasure blends with the dramatic interest in the active games even of adults, any one knows that has taken part in athletic contests.¹ In the seventeenth month (seventy-first week) she was delighted with a boy some seven years older who played catch with her; as he put it, "I chased her round the table, and now she wants me all the time." When he left the room, she would follow, crying "Way! Way!" (Ray, his name) and seeking till she found him. In the seventy-fourth week she was very happy again in romping with him, though he was rough with her and often knocked her over, at which she never cried. She especially desired to be chased by him, laughing all the time as she ran. Through the nineteenth month she constantly wished to play "catch," running and laughing till she could hardly stand. In the last week of the month she was in wild spirits, romping with the same nine-year-old boy; and when he rolled her over, threw a blanket over her head, and otherwise used her roughly, she took it in the highest glee. She took riotous pleasure in romping with the dog during the latter months of the year. On the last day of the twentieth month, as she was frolicking on the lawn in the highest spirits, he knocked her down by a sudden excited rush. She laughed heartily, called him back, and as he capered about near her she went into ecstasies of laughter, but took care to sit down each time he approached, to save herself a fall. Once when he rushed very close by her, almost grazing her as she sat, she nearly cried with laughter. She would climb all over him, clutching him roughly, pulling his tail and hair, shouting and squealing, and crying, "Sit on Muzhik!" She was especially pleased if he got up and walked off, tipping her over, and would call, "Get off!" and "Get up!" to intimate her desire to have him do this. As the big Russian dog, though reasonably good-natured, did not seem over-fond of her handling, we doubted the safety of such play; but she was bewitched with him, and when he was driven from her, set out to find him and flung herself on him with joy. After she had finally teased him into snapping at her (twenty-

¹ It seems to be characteristic of all unspecialized sensation that while its effect on the feelings is remarkably strong, and the part it plays in life enormous, it is to be found only as a substratum in activities of which something far more complex and definite forms the obvious part.

fourth month) and was greatly interested in the experience and determined to repeat it (see *Feeling*, p. 150, above), the dog was given away. She was equally fearless with another dog that was occasionally about, climbed all over him, and did not mind rough play.

Her romping took an unpleasant turn, quite different from permissible frolics, in an occasional impulse to strike with a stick, or (in the latter months of the second year) to fly rudely at some one who had her in arms, scratching or striking at the face, slapping and clawing at the hair, even biting a little, always in good temper, apparently as a rough joke. I note this from the seventeenth month till the end of the twenty-first. In the last quarter of the second year it was rare; but once at the beginning of the twenty-second month (seventy-second week) when lifted to kiss good-night, she snatched off her grandmother's glasses, then her cap, and flung them to the floor, likewise her grandfather's glasses when the chance came, and refused to kiss any of us good-night, laughing and romping instead. In the last week of the second year she would stop to ask with amusing politeness, "May I pull your hair, aunty?" "May I bang you, aunty?" and would give up the intention on receiving an emphatic no.

With the third year, as implied above, the great interest in muscular exertion that had accompanied both the earlier and later development of the race-movements, disappeared. In the acquirement of these movements in the second half-year, and afterward in the period of delight in the fuller development (fourth half-year), the child had been energetic in efforts that taxed her strength and skill to the utmost; but now this was only partly so. In the twenty-seventh month, I note that she is eager to try novel and difficult things; but on the whole there was a disinclination to occupations that taxed her muscular skill; in the thirtieth month, I note avoidance even of those that called merely for muscular exertion without much demand of skill. "Too hard, — *you* do it," she would say. This was in striking contrast with her zeal in the use of her eyes, ears, and mind. There were many exceptions, however, to her dislike to hard muscular effort in this half-year; at times she would pull and tug to climb, and dig till she was red in the face.

She was, in a more desultory way, about as active in this year as in the second: the ebullitions of frisking, racing, and jumping continued, and notes of her sitting quietly without visible occupation, prattling to herself or seeming in thought, though they do occur, are very few. We rarely ventured to take her to church, but tried it once, at Easter (when she was two years and a half old); she proved hopelessly restless, and soon got up and walked outdoors. Brought back toward the end of the service, she behaved very ill, scrambled about the seat and kicked up her heels, in marked contrast to the decorous behavior of several other little things of her age. (Even at seven years old, she cannot sit the sermon quietly through, without occupation, as they do, but draws and scribbles on a paper, reads the hymns, etc.)

She still experienced great joy in a good romp, but not as much in proportion to other pleasures as in the second year. Once in her twenty-fifth month a boy of six so won her heart by romping and running with her that whenever he stooped for any reason she would seize the chance to run up and embrace him. Her games of chasing took the more dramatic form of "playing bear," with much springing, growling, running, and seizing, peals of laughter and shouts of delight. Other active frolics were also sought: *e. g.*, if I lay on the lounge, she loved to fling herself upon me, tumbling and trampling over me, and to be pushed and rolled off, taking and giving as rough play as was possible without harming her, with the greatest merriment and the utmost recklessness on her part. (A hard romp, especially with father or uncle, is enjoyed still, at seven years; most of all a pillow-fight, in which she asks little consideration for her size and strength, and takes pretty heavy blows with merriment.)

She had been broken of pulling hair and flying in rude play at our faces, but the disposition to such roughness was only modified. A little broom that was given her on her second birthday was used to strike about with far more than to sweep, for a few weeks. In the latter half of the third year I note repeatedly that almost everything the child has to be checked or punished for, is some ebullition of boisterousness, or rough, unsympathetic horse-play, — shouting and kicking her feet at the table, banging the furniture with sticks, gayly assaulting us or the cat (her roughness to whom

became a constant matter of discipline in the thirty-fifth month, and on into the fourth year). In the thirty-sixth month, finding a handy, smooth stick, she struck her grandmother sharply, — without the least temper, merely because the stick was tempting. (This last incident called so pressingly for prompt action that in her mother's absence I made a very rare exception to the rule never to strike another person's child, and turned the stick against herself. This she took in excellent part and related quite approvingly to her mother at night that she did 'pank damma wiv a 'tick, and aunty had to 'pank her wiv de 'tik.) By the end of the year, these roughnesses were mainly checked, except toward her grandfather and uncle, who rather encouraged them.¹

In the twenty-sixth, twenty-seventh, and twenty-eighth months, action songs were a good deal enjoyed: "The Barberry Bush" was liked much better than any finger-songs; and in this, the trunk and leg movements, as in "'kiping to 'cool," were preferred to the hand and arm movements.

That the child experienced not only pleasure but more or less

¹ There was something very hard to understand and classify in this rough play impulse. It had to my observation something peculiarly primitive and involuntary about it, — a quality that mothers recognize when they say, "The child is *possessed* to do so and so." There was an element of cruelty in it, which in the early part of the fourth year differentiated itself in her treatment of the cats; there was a horse-play much like that which continues so strongly until maturity in boys if their training is neglected, or that which is common in the lower animals; and there was a singularly primitive joy in the sensation of *striking*, especially when suggested by a stick in the hands. Thus in the thirty-ninth month, she came to me and said cheerfully, "I was bad to Uncle Joe." — "Were you," I asked: "Why?" — "O, just for fun! I hit him with a stick. It was good fun, — lots of fun." There was some bravado in this, but I did not doubt she had stated her motive truly enough. About a month later, after being charmingly good for a long time, she had another outbreak of rowdiness, and while her grandfather was saying grace — a ceremony which she had from very early learned to treat with strict reverence — she went and got her little broom, and started on a circuit of the table, dealing a thump to each bowed head in turn, till seized; when she remarked with enjoyment, "First I hit papa, then I hit grandpa, then I hit grandma, and then I was going to hit aunty."

It is evident that the subject has wide relations, both in animal and human psychology; but these are better noted under some category of moral or social development.

intellectual interest in muscular sensation, — that it was a subject of attention to her, — was apparent from a few indications. On the forty-seventh day, she showed ludicrous astonishment at a small, high crow (the first she had ever uttered), which had suddenly interpolated itself among the more familiar sounds she was making; there was no reason from her general behavior about sounds to suppose that the sound alone, without the novel muscular sensation, would have excited such attention. In this same week appeared the experimenting with the tongue — putting out and withdrawing the tip — mentioned above (*Sense of Contact*, p. 136). Experimenting with the vocal organs in the fourth month has also been mentioned (p. 189). As soon as she was four months old, the baby was seated daily in a horse-collar on the floor, where she could sit well supported, and amuse herself. Within a week, she began bending herself back over the collar. The sensation (which was, of course, partly one of contact and partly muscular; perhaps sensations of equilibrium were also involved) seemed to wake a special curiosity and interest, and she repeatedly bent her body back with great exertion; bent it so far that the back of her head touched the floor. This touch sensation, which amazed her greatly (see *Sense of Contact*, p. 143), so added to the interest of bending back that she kept it up persistently for a week longer; the next day, in my arms, she began throwing herself back over my arm, and when I let her go as far as she would, holding her firmly, she bent back with a serious and interested face till her head was hanging downward. I did not dare let her persist as long as she would, afraid she might strain herself. In the following days she would bend back till her head rested on the floor, then recover herself. Once (135th day) she abandoned the breast after nursing a little, sat up, looked at me with a broad smile, then began bending herself back over her mother's arm.

In the sixth month (163d day) the baby's grandmother seated her in a large easy-chair, where, nestling about and slipping down, she got her head on the arm of the chair. She then stiffened and raised her body till it rested on her heels and the back of her head. At this she gave a squeal of delight; then relaxing her body, she stiffened it again, and repeated the experiment several times. (This incident I did not see myself; it rests on the grandmother's report.)

At eleven months old, the baby had so far recognized her various actions and associated them with words as to be able to obey twenty-seven different directions. At fifteen months, out of sixty-five words used by her, seven, or perhaps eight, were action words. In naming these actions, of course, what the child recognized and named was partly her own sensation in performing them, and partly the *sight* of herself and others doing so. In the twentieth month, "hard" appeared, in the expression "too hard," of something she thought she could not do. In the twenty-second I find it as an adverb, "Ruth pull hard." In the twenty-ninth month, I find this comment: "This is a hill. We walk up. That is pretty hard. *Oo-oo!* It makes me say '*oo-oo!*'" "Rough," recorded as first used in the twenty-first month, referred to roughness discerned not by the touch, but by the muscle sense in walking over it; thus in the twenty-second month the child apologized as follows for asking to be carried: "Wu' fai' fa' dówn. Gow too wǔ," — Ruth afraid fall down; ground too rough. "Heavy" I find used intelligently from the twenty-second month.

Signs of fatigue in the muscles were exceedingly rare. There may have been an element of muscular sensation in the weariness of continued position spoken of below (p. 208); but activity, during the whole of the first year, seemed incapable of tiring the baby. A few exceptions to this statement will be found under the head of Movements, but on the whole, the great amount of exertion expended during the first year in learning to sit, creep, stand, walk, etc., was surprisingly free from any visible effect of fatigue.

During the second and third years also, although the child was incessantly active, my notes record scarcely any instances of fatigue. The most marked case of it was in the second year, at eighteen months, when one evening, after a hard romp with an older child, instead of being as usual very unwilling to stop play, she came and leaned against me, and when I took her in my lap, asked for "bed," wanted to be laid in her crib at once, and nearly cried when told she must be undressed first. Had she had other children to play with, especially older children, she doubtless would have tired herself out often. At the beginning of the twentieth month, she once climbed the stairs up and down, refusing to stop, until she had

climbed about 160 steps in all; toward the end she was evidently very tired, and her feet dragged, though she persisted. I find mention several times in the second and third years that she played till she was "hot and tired," or "laughed till she was tired," and sometimes that she asked to be carried on rough ground, or after walking a good deal.

The word "rest" was used as early as the seventeenth month, (she would sit down to "rest" when climbing the stairs, or on a stone or box when outdoors); and "tired" by the nineteenth. In the twenty-fourth month, she would say, "Ruth so tired!" flinging herself down; and once: "You tired. You been outdoors, so you lay down." It is doubtful, however, whether she used either word in any but an imitative way within the first three years.

2. Sensation of Motion.

The probability is that sensation of motion exists from the first, and that had I watched for it, I might have detected evidence of it in the form of some change in the baby's expression or behavior when she was moved; but as she was carried about as little as possible in the first month, and merely lifting her from one place to another affected the sense of position even more than that of motion, the opportunity for such an observation was slight. The only notes that I have concerning this sensation are notes of the pleasure afforded by it; and as will be seen, in most cases, the sources of the pleasure were not simply the sensation of motion, which soon became blent with other sensations, especially muscular ones. On the whole, however, it was true that during the first half-year the pleasure given by passive motion exceeded that of muscular activity. With the child's acquirement of power over her own movements, this relation was reversed.

My first note of any indication of pleasure in motion (*viz.*, that the first time the baby was carried about outdoors, on the twenty-ninth day, she showed a pleasure that must have been due either to the fresh air or the motion, since the brighter light seemed unpleasant to her) precedes by about two months my first note of pleasure in active movement. Enjoyment of being wheeled about in a baby-carriage was evident from the first time she was taken out thus (thirty-eighth day). That the pleasure was mainly a sort of

tranquil comfort in the feeling of motion, was evident from the baby's behavior: she did not smile or crow, but lay with a blissful expression as long as the motion continued, and soon began to fret if it stopped. For weeks after she was constantly desirous of sitting up indoors, she was content to lie down in the baby-carriage, as long as it was moving. In the fourth month, though indoors she was occupied in gazing at things with curiosity, when wheeled about outdoors, she paid no attention to the objects about her, but lay tranquilly looking before her, seeming to care only for the motion. The swifter motion of a drive behind horses gave a keener pleasure, but still tranquil in quality: on her first drive (105th day) she did not look about her at all, and remained perfectly silent till we had driven about half a mile, then uttered one long murmur of exceeding content, and became silent again for the rest of the drive. In the last week of the fourth month, a change appeared: one day (the 119th) instead of lying in still satisfaction, the baby began to utter happy murmurs as she was wheeled about, and presently fretted to sit up; leaned forward to watch me pluck something (the first time she had shown interest in the use of her eyes outdoors); and three days later insisted on sitting up and looking about. From this time her pleasure in being wheeled about, and still more in driving, became more complex and keener; in the eleventh month the mere sight of her baby-carriage excited the liveliest demonstrations of joy and desire.

Meanwhile, in the seventh month (202d day) she showed interest and pleasure but not gayety at being swung in a blanket. In the ninth month, and again in the tenth and eleventh, I find notes of marked pleasure at being swung in a hammock: though usually so active and restless, she would lie still and smiling on my arm in the hammock, or sit quietly beside me. Two or three times in the ninth and eleventh months I put her into a basket and carried it about, or swung it by the handle, to her great pleasure. An exception to the serenity of her pleasure in being carried about with a fairly even motion, was her laughter and glee when some one set her on a carpet-sweeper and trundled her about; but a considerable element of amusing novelty doubtless entered into this pleasure, and she showed much the same glee when she saw another child on the sweeper as when she rode on it herself.

The influence of motion in inducing sleep is one of the commonest nursery observations. My notes on this point I reserve for the subject of Sleep. I have already referred, in speaking of Rhythm, under the head of Hearing (p. 119) to the superior quieting influence of a monotonous jarring as compared to smooth motion. It is frequently said that trotting and jolting babies stops their fretting only by diversion of attention, and this is doubtless true in some cases; but there were many instances in which my niece's behavior showed that there was something agreeable and quieting in the motion itself. Thus on the forty-eighth day her fretting stopped and her discontented expression changed to a happy one the instant her grandmother, who held her on her knee, began to trot her. At this time (second month) if she chanced to be fretting in the baby-carriage as it rolled over the smooth veranda, she stopped and became placid the instant it struck the gravel walk. In the sixth month, it was once necessary to carry her a block or two through the rain, so covering her, head and all, with my cloak, I ran with her. She had begun to protest at being thus muffled, but stopped at the motion, and came out smiling when I reached shelter. Later the same day, when a series of misadventures had left her grievously tired and hungry, her nap broken, her mother detained past nursing time, I ran with her a block or two to catch a train; and she forgot her troubles at once, and stopped crying as long as the motion lasted.

At three months old, she liked to be tossed in her father's arms, and during the fourth month became very fond of a frolic, and would crow and smile in high glee when she was tossed in the air, slid down one's knees, or otherwise tumbled about; the first true laughter I heard from her was over such a frolic in the last week of this month (118th day); and in the first six months this was almost the only cause of laughter. In the fifth month (nineteenth week) she began to coax to be played with, with motions and cries of desire; my notes of this coaxing and of her laughter and delight in the play, are very frequent in the next three months, — for weeks together, almost daily. Thus on the 133d day, seated on her mother's foot and danced up and down (held by the arms), she wore an

expression of rapt delight, and whenever her mother stopped she would set up a little cry of desire. That evening her father played with her at bedtime, and the next night at the same hour she whimpered for a play instead of settling down to sleep. The first recognition of her father that she showed was a month later (160th day) after he had tossed and jumped her a great deal; that evening when he came into the room she showed expectation of a romp, looking at him with laughter and movements of her arms, and for some days after, she repeated this whenever he appeared. In the same week, the twenty-third, I took her in my arms and jumped up and down with her, to her great delight. This became a favorite play, and she would beg for more with cries of desire. The day she was twenty-four weeks old, as soon as she saw me in the morning she began making little wistful cries, with an earnest look into my face and motions of the body; and continued to show signs of desire for half an hour, till I gratified her. Three days later, after a frolic of the sort, I put her down in her mother's lap: she looked up, laughing and springing with her body, but when I left the room she stared after me with an expression of surprise and grief (as I saw through a crack of the door). I opened the door and spoke, and she broke into smiles and movements again. This was repeated several times; then I remained out of sight. She looked sober for about ten seconds; then, with her usual easy surrender of desire, looked up to her mother's face and laughed.

In the twenty-fourth week her father began another play that was very delightful to her, — swinging or tossing her into her mother's arms, or mine, to be swung back into his; sometimes the three of us passed her thus from one to another. This excited great hilarity; she reached her arms from one to another and laughed aloud; and when the frolic was stopped and she was taken from the room, she set up a remonstrant whine. I have a number of notes afterward of merriment over this play and desire for it.

In two or three cases at least, she knew very well which play she wanted, and when her coaxing sounds and outstretched hands had persuaded one of us to take her for a romp, she looked only moderately satisfied until the right play was hit on.

In the second half-year, her love of this passive play continued for a time. During the seventh and eighth months, it was quite

common for her to fret and coax for a frolic in the evening, instead of going to sleep; and in the eighth month her desire to go to people was almost entirely according as they would frolic with her, — though by the end of the eighth month she had made distinctions, and while she had no use for her father unless he would toss and play with her, she was happy with me without the playing. After this her great desire for such play disappeared, displaced by her growing desire for self-activity: though I find a few notes in the tenth and eleventh months of laughter and delight in being rolled and tumbled about, or tossed from one person to another. Once at forty-four weeks old, she was very happy over being walked with rapidly, and for many seconds uttered a crow with each inhalation and a joyous murmur with each exhalation. At another time, when just forty-seven weeks old, she tried repeatedly to creep to a pitcher that stood on the floor, and each time I pulled her back by her dress and rolled her over on the floor, a rough treatment that was received with peals of laughter instead of displeasure.

In the sixth month, I had once chanced to amuse her by jouncing her up and down on the springs of a bed, a motion that pleased her greatly: in the tenth month this became a favorite play, constantly mentioned in my notes. She liked to have the jouncing violent enough to fling her about, and liked best to take it lying on her face, so that her face was thumped roughly into the mattress, at which she would laugh aloud with delight; but it pleased her greatly also to be flung off her balance when sitting, or on her hands and knees. If I stopped, she would wait a few seconds, then indicate desire to go on by springing movements of her body, or by rolling over with her face flat on the mattress and making little murmurs of desire. The 259th day, after I had carried her into another room and put her down, she sat and looked earnestly at me with urgent chatter, an unmistakable appeal to be taken back to go on with the play.

In these plays it is evident that the simple sensation of motion was more and more mingled with other sensations, those of touch, position, equilibrium, even of muscular activity, from the involuntary flinging about of limbs and balancing of the body. The pleasure of muscular action and of passive motion were almost equally mingled in jouncing up and down to rock the baby-carriage on its springs, or

sitting in a little rocking-chair and making it go by movements of her body (at first jiggling it awkwardly, but by the forty-fourth week rocking it quite nicely, though her legs were too short to hang down over the edge of the seat) — employments that were much enjoyed from time to time from the thirty-second week to the end of the year. In the twelfth month she would persistently climb to her feet in the baby-carriage, to rock it from side to side, at imminent risk of falling.

On the other hand, in the middle of the twelfth month (350th day) she laughed very much over a play in which there was no muscular element: merely being sent back and forth in the baby-carriage between her mother and me, from end to end of the veranda, by a push that sent it safely along the smooth pavement; then when her mother began to roll the carriage and reverse its motion with a jerk, keeping time to the motion with rhythmic sounds, the baby was enchanted; she would begin to laugh in joyous expectation of each jolt as she perceived it approaching.¹

¹The main pleasure of such a play is certainly in the *arrangement* of the motion and sounds, — a rhythmic series, ending in a shock; all babies, so far as I have seen, after the first six months, are amused by rhythmic motions or sounds (better both joined) ending in an explosion, or sudden climax; as one may see by simply remarking to a baby, "Bobby-bob, bobby-bob, BOB," with accompanying demonstrations of head and hands, — or taking the little hands and patting them together some half dozen times, ending with a clap, — or any one of fifty like exercises, familiar to every nursery. If the baby is a merry one and not timid, such experiments will be rewarded with peals of laughter and pleas to continue, till the experimenter is thoroughly bored with his own performance. But the forms in which the rhythm and concluding jar are most appreciated by the baby are those that affect his own body; a series of threats ending with ducking the head into his bosom is more amusing than one that ends in a mere hand-clap (or *vide* the favorite play, "Creep, Mousey, Crawl"); and there were several instances in the case of my niece besides the above (see self-invented plays under Movement below; and the sliding downstairs, p. 207 below) which show that a heavy jar of the whole body was a particularly interesting form of climax.

It seems to me clear, also, that healthy children experience little of the unpleasant sensation from jar that their elders do. At eight or nine years old I used to play, with several other children, at finding our way with shut eyes in a meadow that broke off into gullies with banks some two to five feet high; and we thought it much better fun to miss our way and plunge over these banks than to reach our goal safely. If I remember right, some headaches resulted from going over the highest places, which led to the play's being dis-

In the second year pleasure in mere passive motion declined, as the child's power over her own body increased; and in the nineteenth and twentieth months, she became positively averse to vehicles thus, in the eighty-seventh week, I note that she was disposed to whimper when she heard something said about driving, as her bonnet was put on, and begged, "Walk! walk outdoors!" and in the ninety-first week, that she was borne off to drive, protesting lamentably that she wanted to "walk on feet." There are also many notes of unwillingness to be carried. This lasted during the whole half-year, but with the third year she became first reconciled to driving, then moderately fond of it; and in the twenty-seventh month, though impatient of sitting still in any one's lap for a chat, she liked to have me take her in my arms and walk about, chatting with her. In the thirty-second month, she was greatly pleased at being set on the seat of a bicycle, and wheeled about.

I find some note of liking for the hammock in the second year. A little swing was given her on her second birthday, and swinging at once became a favorite amusement; by the thirtieth month, she wanted to be sent as high as the ropes (over four feet long) would take her; in the thirty-third month especially, she begged daily to be swung, and swung *high*. She has had, in her sixth and seventh years, a swing with ropes eighteen feet long, and likes to be swung as high as the stoutest masculine arms can send her.

During the first half of the second year, I find a few notes of her continued pleasure in being jounced on mattress springs, but the play was probably stopped as she grew rather heavy for the springs.

She continued in this half-year to like rocking in a chair, but now with a smooth and gentle motion; and to be tossed, swung, and rolled about (as, indeed, she does still). In the sixteenth month she was deeply delighted when a guest took her in her arms and danced with her,—an entertainment she had never had before,—and was hardly willing to let this guest out of sight the rest of the day; the incident made an unusual impression on her memory, also. Such plays as "Shoe the horse," "This is the way the ladies ride,"

covered and stopped; but when the bank was not more than two or three feet high, I remember the fall and jar as an exciting pleasure.

On the other hand, an unexpected fall and jar could frighten my niece very much.

"Trim-tram," "Ride away to Boston town," gave pleasure; in "Boston town" (seventeenth month) she would begin to smile in anticipation as the climax, "fall down," approached.¹ In the seventy-second week, her father placed her on the footboard of the bed, and repeating, "Humpty Dumpty," tipped her over on the bed with the word "fall." She was delighted with this and wished it repeated a dozen times. In the twenty-first month, in a cable car where we were the only passengers, she insisted on walking back and forth on the empty seat the length of the car, enjoying the way she was flung about by the jerking of the car (guarded by me, of course, from falling). At twenty-one months old, she liked to go down-stairs, held by some one's hands, sliding on her feet from step to step with a racking jolt. In the twenty-eighth month, when traveling on the cars, her favorite occupation was to climb up on the window-ledge, and fling herself backward from it into our laps with entire abandon.

An incident of the eighteenth month (535th day) showed an ability to imagine and desire (though doubtless most imperfectly) a joy of motion outside her experience. She had all day been running toward the birds that lighted on the ground, and saying "Catch!" At last, when they flew up, she put up one little hand, saying "F'y!" in a tone of desire. "Yes, the birdies did fly," I said; but she repeated longingly, "Wu'! Wu'! F'y!" "Does Ruth want to fly?" I asked. "E" (yes). I took her and tossed her up into the air, which seemed rather to divert her mind than to satisfy her desire.

The words *fast* and *slow* were used from the eighteenth month, in a very limited way, — of her own pace in walking.

3. Sensations of Position.

The complex sensation of position seemed to me to form itself early, since by the fourth week a certain position was quite distinctly associated with the satisfaction of hunger, — long before any sight association with the breast could be detected. Associations of position with sleep also were quickly formed. I shall

¹ Ride away, ride away, to Boston town,

But take care, my little girl, that you don't — fall — *down!*"

With the last words, the child is tipped backward from the knee, held by the hands from falling.

speak of these associations under the heads of Hunger, and Sleep, however. From the middle of the second month, the baby had favorite positions, which she greatly preferred to ordinary lying down: one a position in which her grandmother held her, almost sitting up; another lying along the knees, feet against the body of the one who held her, and head in the extended palm; another (third and fourth months), lying up against the shoulder. The desire to look about her had much to do with her liking for the erect positions, but she evidently found them very comfortable also; on the knees, or against the shoulder, she would readily go to sleep. (See note, opposite page.)

Sensations of fatigue, due to continuance in one position, were early apparent. From the first the nurse took such fatigue into account as among the regular causes of restlessness, and would change the baby's position when she was fretting and no other reason for discomfort appeared; and as a rule the fretting would cease. Until the baby became able to change her position herself, weariness was regularly announced by fretting sounds, which by the fourth month would rise to a whimper, and threaten a positive wail if she was not moved. When she had learned to turn over, she always did so before long if laid down on her back (latter part of fifth month); but soon wearied of the new position and fretted for relief; when she could roll over and back again, however (seventh and eighth months), she was happy by the hour, rolling and kicking on the floor or lawn, without desiring the least attention.

I have also a number of notes, from the end of the fourth month on, of her getting tired, after twenty minutes or so, of sitting in her high-chair, or any similarly restricted seat, and fretting to be taken from it, when she would at once become jolly. In this, however, there was probably not as much real fatigue from continued position as mental restlessness, and discontent from the prohibition of active movement.

The weariness from continued position, which was unmistakable during the first year, and in a less degree throughout the second and third, was evidently a complex sensation, in which the vaguely unpleasant feelings arising from impeded circulation are likely to have made up the principal part. Probably there was

also some muscular fatigue from the continuance of one set of contractions, — though considering the relaxed condition in which a young baby lies, this must have been in the earliest weeks, an unimportant element, if it existed then at all. Pressure from the weight of the body on the muscles and skin would have more share in the discomfort.¹ We ourselves experience numberless incipient sensations of weariness, pressure, and restraint, and relieve them, scarcely consciously, by all manner of slight changes of position, general or local. The entire helplessness of the young baby thus to relieve them, even after they become severe, is not sufficiently remembered; and this neglect doubtless accounts for much mysterious fretfulness. It is an old practice of careful mothers to change the position of a baby at intervals during long-continued sleep; partly because they believe it affords relief, and makes sleep easier, and partly to prevent fixed habits of position that will make growth unsymmetrical.

4. Sensations of Equilibrium.

Equilibrium sensations must have accompanied the whole process of acquiring the balance of head and body, and this began in the first month; but until its later stages, (learning to stand and walk,) the child's manner did not show consciousness of them. In these later stages feelings of insecurity, and pleasure in feelings of assured equilibrium, were abundantly shown. In being carried about in the arms of others, in being tossed, etc., she showed no sign that I could detect of such feelings; though they may have formed part of the pleasure of being tossed, swung, etc., as we ourselves experience them in swinging, sliding, wheeling, and the like exercises. See also on p. 198 above.

I never saw any sign of a sensation of giddiness; neither swinging, rocking in the hammock, nor being tossed and swung in all manner of ways in people's arms, seemed able to cause it. Up to

¹ The extent to which we feel the weight of the abdominal viscera alone can be realized from the curious sense of relief given by certain gymnasium exercises, in which the weight of these viscera is taken from the muscles that usually bear it, and thrown upon the diaphragm. A change in the direction of the visceral weight probably had to do with the pleasure in being held erect.

seven years old, she has no knowledge of the sensation except when she deliberately produces it by spinning round and round, or by twisting her swing ropes and allowing them to untwist. She does not find the sensation disagreeable, and seeks it for amusement; and this is, I think, the rule with little children. Dizziness seems to be less easily produced in them, and to be a less disagreeable sensation than with us. It is unusual to find a child that is made dizzy by a swing; and little children love to get into an old-fashioned cradle, or anything that will tilt to and fro, and to rock themselves by the hour with considerable violence, playing at ship or stage. All the children that I played with as a child used to spin about to produce dizziness, and amuse themselves with the stumbling about afterward, and I do not remember finding it disagreeable.

ORGANIC SENSATIONS.

1. Hunger and Satiety.

Although the baby seemed to require scarcely any nourishment at the first, and for a period whose length I have failed to record, (certainly more than forty-eight hours,) seemed comfortable and well without food, yet some sensation of hunger or thirst, which it required only a little warm sweetened water to satisfy, was shown by signs that the nurse could recognize. As soon as placed at the breast she sucked strongly; and in the following days there was some little crying from hunger, which the nurse seemed able to distinguish quite certainly from crying for colic, though I was not able to do so.

Until nearly the end of the tenth week, the interval between meals was two hours, but hunger appeared somewhat irregularly, often some little time before the expiration of the interval; once (50th day) the baby was fiercely hungry in an hour and a half. (In this case she had been awake, bathed, talked to, and played with during the whole time, though without showing any excitement. I had an impression that as a rule hunger was hastened by an excess of occupation for the brain and senses, but I did not see any distinct evidence of this except in the one instance; the conditions were probably too complex. Conversely, it was certainly true that sleep delayed hunger.) On the 76th day she refused to take the breast until four hours and a half had passed, and after that would not take it at a less interval than two hours and a half, so this became the regular period. By the fifteenth week the baby sometimes positively refused to nurse at this interval, turning her head away and holding it so rigidly that it could scarcely be forced to the breast. She would then become hungry about half an hour later; so in the sixteenth week the interval was extended to three hours. In the first week of the seventh month, 188th day, she refused to eat at the interval of three hours; the next day at three hours and a half; two weeks later, she often refused to eat till four hours had passed, though sometimes she insisted on food in two and a half hours.

In the first two months, when hunger was apt to anticipate the two-hour interval, it was not thought best to break much into the regularity of feeding, and the baby was sometimes kept waiting ten or fifteen minutes after she was hungry. At these times hunger seemed to come on her suddenly, her pleasant mood changing at once into fretting, without any intervening gradations; then if waiting was prolonged, the little discontented noises would rise to crying, sometimes loud and imperative, sometimes a sort of complaining cry that rose to wails and sank again to murmurs. On the 45th day I find moving the arms and pursing the lips as in sucking mentioned as signs of hunger, and for about two months afterward sucking movements and sometimes smacking sounds were regular signs of moderate hunger; sometimes her fist, accidentally brought to her mouth when she was hungry, was sucked. If her face was held up to one's cheek when she was hungry, she would lay hold on the cheek with her lips and suck it frantically. In the fourth month pursing the lips, sucking, and smacking, became habits without any connection with hunger; in the sixth month I thought smacking denoted hunger, but it was not done regularly enough to make me sure of this. On the 46th day I mention a doubling and stiffening of the body while crying with hunger. After the baby had begun herself to extend the interval of nursing, it was rarely that hunger anticipated the offering of the breast, and when it did it was only in a moderate degree; I find but a single record of crying for hunger, and only now and then of fretfulness and complaining noises. In the sixth month when the baby was taken on her mother's lap and unbuttoning the dress began, these sounds would pass into an excited whimpering, with tugging at the dress. Once in the ninth month I note that she cried for the breast when the time came and nursing was for some reason postponed after her mother had once taken her: I mention expressly that it was rare for her to seem thus eager and hungry.

Sensibility to disagreeable impressions was heightened by hunger: to be dressed while hungry, *e. g.*, was a great grievance. While hunger was being satisfied, on the other hand, sensibility was lowered, if I may generalize from the experiments recorded under Hearing, 23d day (p. 107). Yet once while nursing she was considerably startled by a chunk of coal dropped on the hearth, (134th day, see Hearing, p. 108.)

It seemed evidence of the importance of the sensation that the satisfaction of hunger (together with a sensation of position) made the material of the first distinct association, at three weeks old. I noticed at this time that when the baby was crying with hunger, she would at once become quiet on being lifted in the arms in the position usual in nursing, or laid on the bed beside her mother, where she was often nursed. By the seventh week, when crying loudly with hunger, she would stop as soon as she was lifted, as if in expectation of being laid in her mother's arms, or when already in her mother's lap, of being raised to the breast. On the 49th day, I saw her open her mouth for the nipple when her mother chanced to lift her into the nursing position, though it was not nursing time, she was not hungry, and the dress was not open, and up to the tenth week, she would as readily stop her cries when lifted to any one else's arm as her mother's. The early association between sucking movements and hunger (45th day) has been spoken of just above. Another early association connected with hunger, approaching nearer to real memory, was due to the mother's habit of washing out the baby's mouth with a soft cloth before nursing her; on the 47th day the baby stopped fretting when this was done, just as when lifted in the arms to be nursed; and afterward showed in other ways plainly that she associated the ceremony with the coming satisfaction of hunger.

The playing, or experimenting, with the tongue and lips that appeared in the seventh week, I have referred to interest in touch sensations (p. 136, above). So too with the tendency to put everything to the mouth, to lick, suck, and bite, so conspicuous in the first year: I refer it more to touch interest, and to ancestral habit now become meaningless, than other observers have done.¹ Nevertheless, association with the pleasure of food in the baby's individual experience may have its influence, in both cases. This tendency appeared in my niece in the tenth week, with putting the fists

¹ "Probably we have here a case of primitive logical inference: up to this time sucking and tasting were the most important strong, agreeable sensations the young being has known; when, therefore, he has a new agreeable sensation (*e. g.*, of a bright color, a round, smooth body, a soft surface), it is brought into association with the lips and tongue, through which the pleasurable feeling at taking in the sweet milk was received." Preyer, *The Senses and the Will*, p. 249.

to the mouth constantly, sucking and mumbling whatever fraction of them she could get inside, and putting them back when taken away; of its farther development I shall speak under a later head. Opening the mouth as an expression of pleasure (twelfth week), may have been a reminiscence of the breast.

In spite of these indications of the importance of the sensation, and the imperativeness of the demand for food sometimes in the first and second months, I could not see that hunger, even in these earliest months, was as important in consciousness, compared with other sensations, as I looked to find it. In the ninth and tenth weeks the desire to be lifted to a sitting position was expressed by just such fretting at first and imperative wailing afterwards as in the case of hunger; and there was on the whole less crying over hunger than over being laid down flat when she wished to be erect. In its first stages, hunger could be driven from consciousness for many minutes by other sensations. During the second month and most of the third, the sound of the piano would stop the fretting for five or ten minutes, — rarely the outright crying after hunger had become imperative, but I note one instance (45th day) when the fretting had almost reached the wailing point before the baby was carried to the piano, but as soon as the notes began she became quiet, and lay perfectly content and attentive some five minutes, then began to move, purse her lips, and at last to fret a little; we did not prolong the experiment to see how soon the actual point of wailing would be reached again, as the time for nursing had now arrived. Watching the piano keys while some one played, together with listening, diverted her completely from hunger for ten minutes or more on the 57th day. It was easier to divert her from hunger (I note in the tenth week) than from the discomfort of being dressed. On the 46th day, though she had been fretting with hunger for some minutes, when at last I laid her in her mother's arms she chanced to catch sight of some white clothes hanging in the sunshine outside the window, and her attention was absorbed in the sight for some seconds. At another time (56th day) she caught sight of a red ribbon at her mother's neck, stopped nursing, and would not go on till the interesting object was put out of sight. In the fourth month she often stopped nursing to throw back her head, look at her mother's face, and smile. The 122d day she repeatedly lifted

her head to look at me if I spoke while she was nursing. The 133d day, after nursing a little, she sat up and looked at me with a broad smile of satisfaction, then began to bend herself back as if in renewal of the experiment in touch and muscular sensation she had been engaged in (see p. 198, above), caught sight of a brass caster on a chair, and remained so fixedly gazing at it that she could not be induced to resume nursing till she had lost sight of it (see *Sight*, p. 81). In the sixth month, after showing some eagerness and impatience when about to be nursed, as mentioned above, diving at the breast as soon as it was uncovered and getting the nipple into her mouth herself, she would nurse eagerly for but a minute or two, then very leisurely, stopping at intervals to sit up and play, returning from time to time to the breast for a little more. The 157th day, *e. g.*, I came into the room while she was nursing: she looked up at my entrance and began to laugh, sat up and put out her hands, and when I knelt down beside her, played with my head awhile, then sat looking gravely and attentively at me while I talked to her mother, breaking into smiles when I looked at her or spoke to her; presently she began to reach about for something to get hold of; she could not be persuaded to resume nursing for some time. So on other occasions: she was almost always ready, after satisfying the first hunger, to desert the breast for a frolic, or to listen, look about, and play; I find note of it up to the last week of the eighth month. See *Sight*, p. 24, for her diversion from nursing by interest in a knot of cords on an ottoman, — a striking instance, because of her remembering the knot all the time she was nursing, and sitting up again from time to time to look for it.

Sleep was not easily broken by hunger. Six hours was a common period of sleep in the first and second months, and seven hours not infrequent in the second month; on the 58th day she slept eight hours continuously, and on the 63d day, nine and one-fourth hours, — two hours being all this time the regular interval between meals, and sometimes too long an interval for her desire when awake. Though sleep no doubt postponed greatly the conditions of hunger, these must have arrived and reached considerable intensity before the end of these longest periods, yet without breaking her sleep. Her behavior immediately on awaking showed hunger sharply present: in the case of the eight-hour sleep, she

waked with a frantic cry of hunger, that roused a sound sleeper in the room above; after the nine and a quarter hour sleep, she did not cry, but fell to sucking her fist vigorously as soon as she was awake. In one case (37th day) she dropped asleep on returning from a drive, before she could be put to the breast, just at the close of the two-hour interval, when hunger must have been already present or close at hand, and slept four hours; and even then showed no sign of waking, so her mother waked her to nurse. In the eighth and ninth months she repeatedly slept through the midnight nursing time, thus dropping out one of her daily meals.

Nor did I find the satisfaction of hunger the great, dominant pleasure of the early months, as other observers have done. She nursed from the first with energy, and with an expression of great content, (eyes closed, as I have noted above, *Sight*, p. 12; not open, as Preyer records); in the second month, she uttered little grunts as she sucked, — probably merely from losing breath, but they certainly had a sound of high satisfaction, and similar sounds were made when she was lying in great general contentment on the lounge. Still, from the first, there was just as marked an appearance of pleasure in the bath, and after the middle of the second month, demonstrations of much higher pleasure in sights, such as faces, a spot of sunlight, strips of color; these she greeted with movements of hands and feet, while she panted in short, audible breaths, — or in the third month, with smiles and murmurs. Once (47th day) she showed this high enjoyment, with movements and panting, from a general sense of freedom and well-being, as she lay naked after her bath; but never in connection with food. So again in the fifth month I note that her smiles, crows, gurgles, and movements of hands and feet are for pleasure chiefly in faces and voices, and secondly in general well-being, but not in eating. Her first special interest in a person (in the fifth month) was not in her mother, the source of supplies, but in her grandfather, who played with her most to her liking.

She never took more food than she wanted, and regurgitation of the milk scarcely happened half a dozen times during the whole period of nursing. From the fourth month she would stop decisively when she had had enough, thrusting out the nipple and turning her head away.

Though hunger and its satisfaction played a smaller part in the baby's direct consciousness than I had expected, its effect on her general condition and mood was controlling. With the beginning of the second month it began to be noticeable that after being fed, if she was at the same time warm, dry, wide awake, and in entire health, she was not only in the highest good temper, but at the best in activity and mental alertness; in at least one case (47th day), I noticed at such a time a very notable advance step in development (see Grasping, below).

The 137th and 138th days she wanted constantly to be amused, making sounds of dissatisfaction and desire. When diverted with a plaything she would cease the whimper and utter happy gurgles; but by the afternoon of the 138th day she grew more and more restless, and kept up her complaining cry incessantly except when walked with. As the child seemed to be in perfect health and abundantly fed, it was hard to tell what was the trouble, but the grandmother said that she seemed like a baby in need of nourishment, and that though the mother's milk was apparently quite sufficient, it might have been affected in quality by a toothache from which she had been suffering for days, and advised a little supplementary nourishment; so the baby was at once given four tablespoonfuls of cream and hot water. The effect was quite magical, and I was called downstairs about half a minute after the dose had been administered, to see a transformed baby kicking and smiling on the rug in perfect content. For some days one daily meal of this diluted cream, supplementing the mother's milk, kept her well-fed and content.

Apparently in this case the discomfort had not been due to any definite sensation of hunger, of which no signs had been shown, but to a general organic discomfort from defective nutrition. It could not have been due to any toxic condition of the mother's milk, but only to a slight impoverishment in its quality, since the cream was substituted for the natural milk only once a day. It was noticeable that the presence of food in the stomach *instantly* relieved the discomfort, apparently before the effect through the circulation could have been felt; but it is common enough with every one to have food instantly relieve faintness, depression, and other apparently remote effects of insufficient nourishment.

On the 171st day occurred another instance of instantaneous relief from great general discomfort: the child had been for some hours sleepy, tired, hungry, frightened by a stranger, and separated from her mother, whom she had for the first time missed and cried for; but when at last she had been fed, she rolled over on the bed from her mother's breast, looked up and laughed in my face, and was ready to come to me and play, though she had been crying in my arms just before, afraid of being separated from her mother.

The foregoing notes concern entirely the period of nursing. Between the twenty-third and forty-sixth weeks (see detailed account of diet at the end of this chapter) this period overlapped that of general food, as the mother's milk failed and was gradually replaced by other nourishment. There was thus at no time any definite weaning, and other habits of food were entirely established by the time nursing was given up; the baby was hardly aware of the transition. Nevertheless, in the first experiences of artificial feeding, the discomfort of taking milk from a spoon as compared with nursing at the breast was sometimes obstinately resented, and now and then it was necessary, in order to get it coaxed down at all, to divert the baby's attention with a little bell while the spoon was placed to her lips; she would then swallow the milk absently, without noticing and protesting against the spoon. A little later (twenty-fourth week) she discovered that she could scatter the milk about by a sputter with her lips just as the spoon reached them, and preferred this to swallowing it, so a bottle was substituted, with which she tried in vain to play the same trick. In the eighth month a cup succeeded the bottle; this too was disliked, and she had to be coaxed and urged through the daily meal that was taken from it. To be urged to take food from either cup or bottle when she was sleepy was a serious grievance, over which she sometimes cried hard.

During the whole period of transition there was much fluctuation in the baby's appetite, and as her food became more varied, it was impossible to tell how much of her behavior toward it was due to taste, and how much to organic sensation. Hunger was scarcely ever shown: once (266th day) the baby cried for the breast when

she was put off after the time had come and she had been taken into her mother's lap to be nursed; I mention with this note that it is rare for her to appear thus eager and hungry. During a railroad trip in the forty-third week, when she was hungry she would point to the satchel in which crackers and a bottle of milk were kept, and once, having eaten all the cracker in her hand, she pointed to the floor with an urgent sound, for the crumbs. In the same week she expressed desire for food by begging sounds, rising once to a clamor of impatience. A few days later (304th day) when her mush appeared at the breakfast table, she pointed to it with laughter and clamor of eagerness. Desire for food, and pleasure in eating it, were not infrequent, but it was not usually as clearly due to appetite as it seemed to be in these cases, but rather to taste, some favorite food being the object of desire. New foods were sometimes accepted with eagerness, but after a few weeks ceased to excite pleasure (see above, Taste, p. 163). The most consistent demonstrations of desire and pleasure were for fruit-juice (Taste, p. 165), which could hardly have had much to do with the satisfaction of hunger, yet may have met some organic need. In the fortieth week, she would refuse to take her milk in her high-chair at the table, and beg to be put down on the floor, where she was willing to take it in small doses, interspersed with play; she would from time to time creep to her mother's side, pull herself to her feet, and hold up her head and open her mouth for a drink of milk, then creep away again. Lack of appetite and indifference to food are often mentioned in my notes, usually when there was no ill health to account for it. In the tenth and eleventh months especially, as the proportion of food that could be had from the breast became inconsiderable, it was difficult to get the baby to take enough food for proper nourishment, and she grew perceptibly thinner; she had been during the first half-year a remarkably plump baby, and it was not till the forty-second week that the deep crease about the wrist disappeared. Under the circumstances, with the advice of the family doctor, she was given a more solid and varied diet than is usually allowed at that age (see below, p. 231); immediately on its adoption her appetite revived, and it seemed to agree well with her; her weight also, which had decreased in the tenth month, returned

to its former rate of increase.¹ Most of the signs of hunger and genuine eagerness for food mentioned above were at this time. By the forty-fifth week, however, the indifference to food is again noted, and she wished to diversify the uninteresting process of eating in all sorts of ways. For example, the 315th day, after taking a little food at lunch, she began to intimate by complaining sounds and look and motion toward the floor, her desire to be set down; after taking a few spoonfuls standing on the floor, she crept over to her grandmother and asked her for more; then begged with outstretched arms to come to me, accepted a spoonful or two from me, then wished to get down to the floor again. In the afternoon she greeted the appearance of her mush with laughter and motions of joy, and scrambled from my lap to her mother's to get it, but soon tired of it, and the rest had to be coaxed down. The 324th day she began to take her food readily enough, sitting on her mother's lap, but soon stopped eating to point at her uncle's hat with a sound of desire, and intimate a wish that I should put it on; next she wished to come from her mother's lap to mine and be fed there; then lay back on my arm, and let her mother feed her so for a few spoonfuls; soon tiring, began to scramble about and play with the hat, and coax us successively to put it on, refusing to take any farther interest in food.

The last daily nursing (at midnight) was given up in the forty-sixth week, a glass of milk being substituted for it after a few days. The general conditions of appetite continued the same as during the last two months before weaning was complete: I constantly note indifference to food, and difficulty in finding things that she will eat.

¹ In an interesting record by Mrs. Edith Elmer Wood (B. L., Smith College, '90), which has been kindly put into my hands, I find the note that her boy was weaned near the end of the 12th month. He fought against the change the first day, was plaintive for several days, then accepted the situation and ate with avidity, though up to the 15th month he made frequent efforts to nurse. He refused a nursing bottle from the first, and drank from a cup. He was given milk, oatmeal, potatoes, Imperial Granum, beef juice, chicken broth, and toast,—a dietary not very different from that of my niece at the same age. It appeared to agree with him, and he improved at once in sleeping, waking only once and taking only one meal between 5:30 P. M. and 8 A. M. Six months later his mother records that he has always been in perfect physical condition, and has never had a really sick day in his life. Mrs. Wood's table of weights, however, indicates a slightly checked growth at the time of weaning.

She would not eat more than three times a day, (once only I note that she gets a fraction of a fourth meal at the family dinner, somewhat later than her own); and even when she liked some offered food pretty well, she had to be followed about with it and coaxed to eat. She would sit in her high-chair and take a little, then beg to get down; creep under the table and find her grandmother, get into her lap and take a little more, then slip down again and creep about the floor, take a little more standing by her mother, etc. "Prefers playing about to eating," I note in the forty-eighth week. Occasionally pleasure in some food, or comparatively good appetite, is noted, but the rule is indifference to food. Since this readiness to desert food for play, or to intersperse eating with attention to other things, was equally marked in the nursing period, (p. 215, above) it had nothing to do with the change of food.¹

It will be remarked at once that hunger is a sensation which has little chance to make itself felt in a well cared for child, whose needs are always anticipated: and it is true that when this baby's lunch was once late for an hour, (at just eleven months old,) making about 5 ½ hours' interval, there was a perceptible increase of appetite; and again in the same week, when she had slept three hours later than usual, an hour or two past her breakfast-time, her first act on waking was to climb to her feet in the crib and reach for the cup that held the remains of her midnight lunch. But I should certainly have expected that an active and healthy child, even though regularly fed, would find the interval between three meals a day long enough for a considerable development of appetite.

¹ Mrs. Beatty's record gives an instance of the suspension of interest in food by a more mental interest, in the eleventh month. She had brought her baby in from a ride, and gave him to the nurse to hold while she prepared his supper; and the nurse, having occasion to go to the basement, where the kittens lived, carried him with her, and came back without stopping to show him the kittens. The baby began to cry, and the nurse, guessing the trouble, asked if it was the kittens he wanted; he answered by demonstrations of desire, but his mother now put him in his high-chair, and offered his food. The baby refused to touch a mouthful, turning from it and holding out his hands to the nurse and crying, till she took him to see the kittens; after which he ate his supper contentedly.

Mrs. Sharpe's boy at one year, though he habitually preferred his mother, would leave her readily for the maid at the suggestion of food.

With the second year a considerable increase of interest in food was visible. I find but one reference to downright hunger ("Waked from a nap very hungry"), in the seventy-ninth week; but the child often asked for something to eat between meal-times, and was usually given something, fruit, cracker, or cooky, so that there was little opportunity for hunger. Her appetite was good as a rule, and her food enjoyed, and she sometimes showed eagerness for it. These expressions of eagerness, however, were almost always for some favorite food, so that it was impossible to say how far the desire of agreeable taste caused them, and how far appetite. Thus in the fifty-third week she clamored for her sweet potato all the time it was being prepared; in the fifty-sixth, and at intervals later during the year, she would squeal and shout for sundry desired articles of food, and sometimes ask for more when her portion was eaten. Once in the seventy-seventh week I showed her some small new potatoes cooking, and told her they were for her; she appropriated them as soon as they appeared at table, with a jubilant yell of, "Taty!" and ate them all (four) with zeal. See also instances of pleasure in food under Taste, above; especially pp. 168, 169.

Though eating counted for more than in the first year among her pleasures and desires, doubtless because the gratification of taste was now added to the satisfaction of appetite, yet even with this reinforcement, it is quite striking to see how much larger a part seeing, hearing, and doing played than eating. In the fifteenth month I once note that interest in food suspends all other interests; and once in the twentieth month that fruit, sweets, and meat rank with going outdoors as the objects of prime desire; once also, in the thirteenth month, that favorite foods are next after going outdoors the chief object of desire: but with these exceptions food is always mentioned in a subordinate place among the regular objects of desire, after such things as pictures, learning words, exploring upstairs, jouncing on mattress springs, dolls, playing with books, etc. Among occasional pleasures also, a host are recorded that gave livelier joy than food: such as going out to see the moon, which caused a "passion of joy" (thirteenth month); using a fork, in the fifteenth month; carrying a muff, in the same month. Other interests still easily diverted her from food, and she was almost without exception reluctant to leave play, and especially outdoor play, for her meals.

See Taste, p. 169, for several instances; some others may be mentioned: — At seventeen months, brought indoors to dinner, she cried to go out again; in the nineteenth month, called to go downstairs to lunch while playing with my books, she went readily, saying, "See grandma!" but once there, begged to go back, and consented with very ill grace to eat her lunch; in the twentieth month she said, "No," plumply when told to leave her play with my books and go to dinner, and when carried off, begged hard to go back, with dinner before her eyes; later in the same month, at a restaurant, she was excited and eager over the novel surroundings, slipping down from her chair and trying to run off and explore everything, crying out over things seen, with slight interest in lunch. In the last week of the twenty-first month, she utterly refused to go indoors on hearing the dinner-bell. "Did not Ruth want lunch?" "No." "Not even if there were raspberries?" "No." In the last week of the twenty-second month, she so resented being brought in from outdoors that she did not want dinner, and when set in her high-chair appealed, "Papa take Tootyboo down?" "Aunty take Tootyboo down?" and when refused, began to cry, then essayed, "Want see dear grandma!" and when this failed, broke out into her rare wail, with tears. She was reconciled, however, when food came. In one case (eighty-fifth week), she was diverted from the desire to go outdoors by dinner, but it was the only time I have recorded, and she was influenced by the promise that she should go out after dinner, — a promise that she claimed the instant she was set down from the table. I have also a single note (twenty-first month) of her going cheerfully into the house when lunch was announced, and the note expressly comments on it as rare. For one or two instances, on the other hand, of the subordination of other interests by the idea of food, see Taste, p. 169.

Desire for food, up to the sixteenth month, was regularly expressed by the same asking sound that indicated other desires, often with pointing; occasional outcries of eagerness are mentioned above. During the fifteenth month, smacking the lips was again, as early in the first year, a frequent sign of desire for food.

I have but a single note of what might be called a sensation of

pleasure in satiety: in the eighteenth month, after a good dinner, (535th day) she "lolloped back in her chair, in a condition of ridiculous felicity, grunting with contented repletion." After this she became active, and ran about in great spirits; and I note again at the beginning of the twentieth month that "after dinner she was in boiling-over spirits;" but this happy activity was so common that I was not able to establish any regular connection between it and a preceding meal.

In the third year, although her appetite seems now to have been almost uniformly good, and there was no trouble in having her take food enough, eating played a still smaller part in her desires and pleasures than in the second year, and is rarely mentioned at all in my record of them. Fruit and sweets were strongly desired during the whole year, and meat at times; but these were desires mainly referable to taste, I thought. Once in the twenty-sixth month she was so interested in what she regarded as "writing a letter to Cousin Teddy" that she could not make up her mind to leave it, till dinner was almost over; and as she was making a careful and interesting piece of imitative scribbling, she was allowed to finish it, and sat by the table where others were eating dinner, diligently hatching little marks across a sheet of paper, without the least interest in the food before her; and after the "letter" was done, she insisted on going and putting away her pencil before she would climb into her high-chair for dinner.

One or two instances of real hunger were noted in this year, however. In one case there had been both an unusual exhaustion of energy and a postponement of the hour of eating. This was on the first day of the year. She had taken the thirty-mile journey to the city, and had experienced much pleasurable excitement in getting a new head put on her doll at a toy-shop; and had then posed at a slow photographer's, and tried to please with a diligence that was fairly pathetic for some twenty minutes, — letting him put the head-rest behind her head, holding up or lowering her chin when told, looking in the direction he charged her to, and holding back her eyes from wandering to her mother and me, without a single murmur or relaxation of effort; not mere passive obedience, for the effort required so carefully to conform for so long,

was very great for so young a child, and required exertion of her own will. On a second trial she evidently tried again to obey directions, but being tired and hungry, had not the patience or had not the nervous control for keeping a pose, and would try a little, then turn and drop to the floor, saying Ruth would sit down. She hailed the idea of going thence and especially of lunch; and (being especially on her good behavior that day) asked politely but wistfully several times before we reached the restaurant, "Mamma, may Ruth have lunch?" "Aunty, may Ruth have something to eat?" When we reached the restaurant, and she found herself seated before a bare table where she had expected food, she quivered into tears, but pulled herself together in the most reasonable way when assured that food was coming. On hearing a cup of milk ordered, she added very anxiously, "And *something!*" and after repeating this without an answer, broke down again, and again stopped crying as soon as she was told she should have a proper lunch. After lunch, though her joyous spirit of the morning was toned by a little sleepiness, she seemed entirely recovered from any nervous fatigue, and it may have been only hunger that had caused her unusual tears before lunch.

Once in the twenty-seventh month she cried clamorously when told that she must not have anything to eat till dinner; and at another time, wished to come back after leaving the table, saying, "I did n't finish my breakfast."

Of interest and attention excited in connection with hunger and eating, — her own consciousness of the sensation and act, — I noticed no evidence in the first year, unless acquiring the names of eatables could come under this head: at the beginning of the eleventh month, out of 84 words whose meaning was understood, *milk* and *cracker* were the only food names; see also Taste, p. 173.

Late in the sixteenth month (480th day) she pointed to the fish-wagon, exclaiming, "Mea'!" — "No, fish," some one explained: "the man is giving fish to Gan." — "Mea'?" she repeated doubtfully several times; then, receiving the same answer, "Fish," each time, she changed to "Fi'!" and after repeating this several times, after her fashion, added, "Da'?" — "Yes, to Gan." — "Ea'?" — "Yes, for us to eat." She pointed to her plate: "Ea'?" — "Yes, that is for Ruth to

eat, too." — "Fò'!" — "Yes, with her fork." After this, curiosity about eating and edibles seemed to increase. She would ask if she might put things into her mouth by putting them toward it, with "Ea'?" When told of a calla, "No, indeed, it is very bad!" she repeated, "Ba'," many times. She found one of the dog's old bones (484th day), and asked, "Ea'?" and carefully breaking off a bit of the dirt that crusted it, called it "mea'," and offered it to the dog. Told that the meat was all gone and the bone no good, she repeated, "Goo' — no, no!" shaking her head and trotting away. In the seventeenth and eighteenth months she would offer the dog any article that came handy, as a block, saying, "Eat!"

In the last week of the seventeenth month (513th day) she showed me some daffodils, asking, "Ea'?" I had just been telling her I was going to take them to the city, and it is possible she thought I took them to eat; or she may have been thinking of a picture in which a cow was eating flowers. "O no, we don't eat flowers," I said. "Did Ruth think we ate flowers?" — "Laly?" — "No, not lady." — "Mam?" — "O no, not man." — "Mamma?" and so on through the family. "We only take daffodils to look at," I explained, after satisfying her that no member of the family ate them. "Loo'?" she repeated, leaning forward and gazing intently at the daffodils according to a pantomime just now connected with the word *look*; then listened intently while I explained that she and mamma and the rest of us ate meat, and potato, and bread, and rice, and the dog ate bones, and the cow grass and flowers, — she repeating after me such names of foods as struck her interest. Her similar inquiries as to whether the moon was to be eaten, in the next month, (541st day) have been related above (Sight, p. 84). In this month (eighteenth) she would often show articles, as a stem of sorrel, and ask if they were good to eat. Yet I felt some doubt whether she understood the word *eat* at this time: she used it of putting dirt in her mouth, with no intention of swallowing; *bite* also was sometimes confused with *eat*; and sometimes even with *kiss*, as if the action as seen, not as felt, was described to her mind by the words.

She tried to make me eat for her amusement, and to feed the doll (as she did afterward from time to time, at first perhaps seriously, then in play, even to the present, seven years old), and took a good deal

of interest in feeding the pigs; still, these were only a few among a hundred experiments and amusements, and did not show a special curiosity about food and eating. She did not use the word *food* during the whole second year, but *lunch*, used at first generally of any meal, was by this month extended to mean any food. Asked, "What does Ruth eat?" she would say, "Lunch." Urged farther, "But what does Ruth have for lunch?" she would name potato, bread, etc. She took a great deal of interest in going out and seeing things cooked, especially if she was to eat them; and this interest lasted at least to the end of the nineteenth month. In the first week of the nineteenth month, she was once in a deep abstraction, still sleepy perhaps, after a nap, and so sensitive to any interruption of her mood that she put up her lip when kissed; but when her grandmother said something about a chicken-bone for dinner, and then suggested that she would want a drink after the cracker she was eating, she rose slowly from her abstraction, and first asked for the drink, then said earnestly, as I took her in my arms, "Wu'! . . . Fi'! . . . Bo'!" adding one word after another with growing trouble, as she found I did not understand. "Find Ruth's bone?" "E'!" (yes). She consented to have the search postponed for some other matter, then asked again to find the bone; but when taken to the kitchen forgot it in the favorite amusement of looking into all the pots on the stove and recognizing the various foods in preparation. She liked at this time (nineteenth month) to call our attention to the fact that she was eating, saying, "Up-eat!"

In the twenty-first month it was a favorite joke to offer to eat impossible things, as bits of stick, asking, "Ruth eat?" or "Eat?" This, I thought, grew out of the serious curiosity she had had in earlier months as to what things really were eatable, and that in turn out of our taking things out of her mouth, or saying, "That is not good to eat." In the last week of the month the joke took the form of offering such uneatables to her father and mother, saying, "Mamma eat? papa eat?" and laughing.

In the first week of the twenty-third month, the flies came about a slice of bread and jelly she was eating in the kitchen, and I remarked, "You see the flies like bread and jelly too." This interested her much, and she began breaking off bits to offer them (though when she came to the end of her slice, her generosity

failed, and she reclaimed the flies' portion). In the ninety-seventh week (the same month) she was very much interested in comparing her own dietary with that of her new baby cousin.

With the beginning of the twenty-fourth month, *plenty* appeared, — "Ruth had plenty;" this was used of other things as well as food, and so did not express merely the sense of satiety of appetite. *Hungry* did not appear at all in the second year; "Ruth want" something to eat, covered the ground well enough for practical purposes, but did not show conscious recognition of the sensation.

Early in this month, her grandmother told her a story of two little girls going to school, — the simplest possible narrative of their starting from home with lunch-pails in hand, playing with their mates, reciting their lessons, and coming home to their mammas; it proved to have a powerful charm, and we were all called on to tell it from time to time, even to the end of the third year. I suspected by the time it had lasted a few weeks that its charm lay largely in the lunch-pails (or baskets), whose contents were carefully described always: in the last week of the twenty-fifth month, she asked for it as the "story about little girl go school with her lunch in a basket," and displayed deepened interest when lunch-time arrived in the story. The first day of the twenty-sixth month she asked for it thus: "Tell story about little girl that went to school and ate lunch. And two cookies." The special interest in the lunch seems to have faded after this, and in the thirty-fifth month, in retelling the story herself several times, she made very little of that part.

In the twenty-seventh month she took up easily the play at having meals with toy dishes, and it has always been a favored one if she has a companion in it. In the twenty-ninth she commented on the cows eating grass; and in the thirtieth played at giving milk to a paper cat. In the thirty-first she dictated a letter, and made special mention of what she had been eating; and the chief substance of a dictated letter of the thirty-fourth month is: "We had some biscuits and we had some olives. We did not have any eggs before." She dictated a number of letters, however, in which food played no part.

In the last quarter of the third year she showed a good deal of

curiosity about the food of animals: was much interested in the food of chipmunks, thirty-fourth month; in that of all the animals she knew about, and in their foraging for food, told with the pictures, thirty-fifth month. In the thirty-fifth and thirty-sixth months (as for years after), she was fond of two stories about chipmunks, one in which the chipmunk crept into a schoolroom and ate the crumbs from the children's lunch, the other in which the chipmunks foraged for nuts. She had in the thirty-sixth month some imaginary parrots concerning whom she romanced, and their food figured largely in the romancing.

Just at the end of the third year I caught the word hungry for the first time, but did not know whether it was used with very clear meaning: she excused herself from telling me something I asked her about at dinner by saying, "I can't tell you, I'm *so hungry* now."¹

I saw practically no evidence that suggestion was efficient in increasing or lessening hunger. If she did not care to eat, it was not possible to make her think she did. An exception to this may be found in the following: During much of the second year, and the whole of the third year (indeed, the habit had begun in the first year) she was fond of going to her grandmother's lap to finish up a meal; and it often happened that after a hasty meal in her own place, she would begin to beg, "Tootyboo go see dear grandma!" run to her grandmother and ask, "Dear grandma, take up Tootyboo!" and in her grandmother's lap eat with relish the same things that had been rejected in her own seat.

¹Of about 90 words used in the 20th month by Mrs. Beatty's boy, but 6 were food-names, and no general word for food, eating, or hunger appears. Once in this month the child succeeded in conveying the idea that he had taken his milk by saying, "Mou'," and pointing to his mouth to show where the contents of the bottle had gone.

Mrs. Wood's boy, from the 15th to the 18th month, used the word *mummy-mummy*, at first as a general name for food and drink, afterwards for drink only; *i. e.*, milk or water. He used *eat* at 21 months. Among 263 words recorded at 2 years old, only 11 food-names are given.

DIETARY AND DIGESTION.

FIRST YEAR.

No food except mother's milk was taken till the 138th day (20th week); then two tablespoonfuls of cream, in two tablespoonfuls of hot water, once a day for a few days.

23d week, the cream and hot water once a day was returned to, as a regular addition to mother's milk.

24th week, changed to top-milk, with hot water, well sweetened.

25th week, the baby would drink a little ordinary table-milk, unsweetened and undiluted, from a glass held to her lips, and coaxed to have it given her in a spoon, but evidently for mere amusement in the imitation, not because she cared for it as food; she did not swallow much.

About the same time she was given a bread-crust to suck and mumble, and by the end of the 8th month this was a regular thing; but little nourishment could have been obtained from it, as it was not swallowed much.

31st week, a few spoonfuls of beef soup and cream were given her experimentally, once; relished, and digested well, but not added to her dietary, as there was no need of it.

34th week, oatmeal gruel mixed with the milk in her daily supplementary meal.

35th week, a bit of dried beef once or twice given her to suck.

During the 8th month, the several experiments in other food had been tried with a view to supplementing the mother's milk more and more; during the 9th, another and then another daily nursing was dropped, as the mother's milk became insufficient, and other food substituted, and sometime early in the 10th month the breast was given up entirely in the daytime.

9th month: — My notes are not quite clear, but one meal daily of milk and oatmeal gruel, and one of milk, in addition to the breast, seems to have been the staple of her food during the 9th month. Bread-crusts were regularly given her to chew; she now swallowed a good deal, and was fond of them; in the 37th and 38th weeks, she had pretzel instead, and preferred it. She now and then called for the ordinary milk she saw others drink at the table, and drank it willingly (Jersey milk, once skimmed, — as rich, probably, as most new milk, but unsweetened and unwarmed).

10th month: — From the beginning of this month, a few spoonfuls of beef-soup daily. Crackers were now given her instead of the crusts or pretzels, — soda cracker at first, but graham flake from the 41st week, and as she had little desire for the milk, or milk and gruel, that made the staple of her food, the graham crackers were an important addition to her diet; she ate a whole one with each meal, and would not take her milk without.

From the 6th month, the baby had been allowed to taste a little fruit-juice now and then: in the 9th month, perhaps once or twice a week, — loquat and orange fresh from the tree. In the 10th month, she was allowed it more frequently, and in increased quantity, (peach and loquat,) so that it may count as an appreciable addition to her diet.

41st week, a little bread soaked with milk.

42d week, oatmeal mush. She had been more and more averse to the oatmeal gruel in milk, and as this and milk, which she cared little for, were the staple of her food, it was difficult to get her to take nourishment enough, and the doctor advised giving the oatmeal in the more solid form. At the same time, baked apple was added to her regular food. Toast soaked in milk was also tried this week.

The effect of this more varied and solid diet seemed almost wholly good: loss of weight stopped (p. 7, above), appetite revived and food was more enjoyed than ever before in the baby's life, and a persistent habit of constipation relaxed at once; the oatmeal, however, did not always digest perfectly. Accordingly,

43d week, a wheat preparation ("germea") substituted for oatmeal.

Graham crackers and milk continued a regular part of the baby's food all the time.

11th month:— 44th week, oatmeal mush was given in the morning, and another wheat preparation ("wheatina") in the afternoon, the baby having become quite averse to the germea. The oatmeal once a day seemed to digest well.

45th week, apple-sauce (stewed) instead of baked apple. Cream was given with the apple sauce.

46th week, tired of graham cracker, and preferred bread and toast crusts again. Nursing at night was given up this week, weaning thus being completed.

47th week, the wheatina given up, as the child became averse to it. She cannot be persuaded to eat more than three meals a day: breakfast of oatmeal about 7:30 or 8; lunch, of baked apple and cream, graham cracker or bread crust, at 12 or 12:30; supper of the same about 5 o'clock, milk with each meal. At 6:30, when the family dine, she gets a little more food, — a few spoonfuls of soup, a little milk, a crust nibbled at a little, *e. g.* The nourishment she was getting seemed quite insufficient, and her indifference to food was again so persistent that, on the doctor's advice, a little minced steak and potato was tried, but was not much liked; the next day, beef broth at noon, which was fairly well liked, but the baby had little appetite for it after a few mouthfuls.

Baked potato and cream was also added to the afternoon meal, and a little rice from the soup was tried. A cup of milk at midnight was given, in place of the nursing.

48th week, she was given a bit of steak to suck, with the idea that she would simply get the juice; but she cared only to bite and tear it, and swallowed more or less of it. It seemed to do her no harm, but care was taken the next time (a few days after) to give her a piece too tough to tear; this annoyed her, and she would not suck it.

Throughout this 11th month, fruit had been given almost daily to suck, — the fruit tied in a thin cloth, through which only the juice could be got. I note on one day, in the 45th week, that the juice of four loquats was thus sucked; on another, in the 48th week, that the juice of one peach was taken in the course of the day. Watermelon was frequently sucked in this way. In one case, she somehow swallowed some of the pulp of an orange, which failed to digest.

I have no note of any harm to health or comfort that was ever apparent from the occasional passage of food through her stomach thus undigested; not even from the bits of chewed paper, leaves, etc., that now and then, in spite of much vigilance, were found to have taken the same course.

12th month:—49th week, sweet potato tried, but she would only muss it around, and would not eat. The oatmeal was now refused, and wheatina, baked pear, soup, cracker, and milk, made most of her diet.

50th week, returned to oatmeal mush, with milk, bread, graham crackers, and toast. Baked apples eaten somewhat. A bit of steak tried again, and as before, she tore and swallowed it; but as it seemed to agree with her well, and as the doctor so advised, she was allowed to go on doing this. As a sample of her lunch at this time, I note an inch and a half of steak, about four inches of bread, and a little baked apple, with milk. Mush and toast at breakfast, soup at night, were continued.

Fruit-juice was taken as in the previous month, and to this was added in the 50th week a little apple flesh, scraped fine.

SECOND YEAR.

13th month:—Sweet potato forms a principal part of her diet, and is greatly liked; the 366th day she ate a whole one for lunch. With slight variation, her dietary this month is mush and milk toast in the morning; sweet potato at noon, and twice or three times a week a bit of rare broiled steak (perhaps three square inches, half or three-quarters of an inch thick); soup and sweet potato at night, with milk, bread, and crackers at every meal, and often apple sauce or baked apple. A light lunch of cracker and milk in the middle of the afternoon, and a cup of milk in the night. Fruit almost every day. 375th day, sucked a chicken-bone, getting some bits of meat from it.

This dietary seems to agree with her well, her appetite for the grain foods and milk improving when a little meat was added to them.

14th month:—Irish potato and bread, instead of sweet potato and graham cracker, neither of which is now liked; offered graham cracker, she will bite it and drop it. Food now largely Irish potato; a whole one eaten for dinner the 403d day. With these substitutions, the dietary much the same as in the 13th month, viz., milk and potato with all meals, besides mush and toast at breakfast, bread at lunch, bread, soup, and occasionally apple-sauce and cracker, jelly and butter on bread. Salt now used more, especially on potato, and relished extremely.

Rice is added in the 37th week, and much liked. Celery now first eaten (60th week), and passionately desired, a taste that lasted at least until the 19th month; but it never formed any considerable part of her food, though she was often allowed to eat a little.

15th month:—Much the same as foregoing: lives mainly on mush, potato, toast, bread, and milk, with baked or stewed apple. Meat three or four times a week, at lunch, or rarely at dinner,—steak or chicken. Meat is more eagerly desired than any other food. A cooky (plain) now and then given, but forms no material part of food.

16th month:—Same as above: but graham crackers again important part of food. Begs for meat at every meal, but accepts refusal easily.

17th month:— Same, but rice more important part of food. No longer clamors for meat except at the time it is regularly given. This month careless habit in the family of giving her things to eat irregularly when she asks for them, oranges, cracker, candy. (Candy first mentioned as given for hiccoughs in 15th month; never much more than tasted till now.)

18th month:— Same. In the 76th week, two nights sleepless and crying, which we credited (though she had a cough) to the eating between meals; this was stopped, and her sleep became quiet.

Fruit was freely eaten all this half-year, (apples and oranges,) always agreeing with her well.

19th - 24th months:— The general dietary was the same as in the former half-year. In the 19th month, especially eager for chicken, and would ask for more at table. In the 20th, graham bread much favored instead of white; a bit of mutton-chop once at least at lunch. A fit of nausea the next day, without apparent cause, was charged to the mutton, and I find no farther note of her having any, though she asked for it several times in the next month. 21st month, at last indifferent to steak; tired also of potato and rice. Egg tried for the first time, and liked. 23d month, sweet potato and chicken favored again.

During the whole half-year, fruit was a chief article of diet, always agreeing with her except once in the 81st week when some one gave her half-ripe loquats, skins and all. Through the 21st and 22d months, fruit was preferred to all other food, and potato, bread and rice were cleared away from her plate with industry in order to reach peach or berries. Most of the time, in these two months, cared little for any other food, and it was impressed on her as a great duty to eat bread or potato before asking for fruit. Strawberries, raspberries, loquats, peaches, watermelon, chiefly mentioned.

THIRD YEAR.

Same staple articles in the main as in the second year. A few additions, — string beans in 25th month; roast beef at some time early in the first quarter-year; corn bread sometime in the same period; olives (ripe) in the 28th month; codfish in the 30th; battercake some time before the 34th, and apparently also biscuit (American sense, of course, — light roll); summer squash, and fresh and canned corn; duck in 36th month. Probably some other things were allowed, not mentioned here, for the record is not complete, as in the first and second year; other fresh vegetables especially: ham and baked beans I find mentioned as articles expressly forbidden. Meat was eaten daily in the third year, but no longer so much preferred to other food as during most of the second year: in the 25th month I mention that chicken is neglected for string beans; in the 26th that fruit is more desired than meat; in the 27th that fondness for steak has declined, but roast beef is liked as well as ever; in the 30th, that chicken is consistently refused for some days, and in general, taste for meat has declined, and bread and jelly is the staple of diet; in the 32d, meat, fruit, and sweets are greatly desired, and would be the exclusive food if permitted. From the 30th month milk was taken reluctantly, and in the 32d refused, and water asked for instead. Fruit taken all the year, — grapes especially, in 25th month.

Of articles not staples of diet, I find the following added in the third year: 25th month, cake, almonds (rarely, — one a day in the latter part of the year), and dates; 26th month, figs; 28th month, bananas; 30th, popcorn; 36th, dried prunes.

Digestion seemed in the main perfect throughout the year: just at the 25th month, there was a period of languid appetite, accompanied with signs of cold; in the last week of the 31st month, early raspberries, though perfectly ripe, upset her stomach, and were vomited, undigested, 24 hours after they were eaten; in the 33d month, an older child gave her large quantities of cherries and loquats, without care as to ripeness, with the result of another fit of indigestion and vomiting; in the 36th month, there was again a little spell of languid appetite, connected with some feverishness and fretfulness, and in the last days of the month another digestive upset, apparently from eating figs, though these seemed to agree with her as a rule.

2. Thirst.

During the first year, when milk formed so large a part of the food, I did not especially note the desire for water: pains was always taken from the first, however, to see that the baby was offered water frequently, and especially when she was restless without obvious cause. Both the doctor and the grandmother were earnest on this point, saying that little babies desired a great deal of water, and suffered much discomfort and harm for lack of it before they could ask. As soon as the child could ask for water, she began to do so, and I noted that at a year old she drank a great deal of water, and craved it. From that time on, I noticed that her craving for water was remarkable. In the thirty-third month, she would not drink milk and invariably asked for water instead, and drank a great deal. At meals she would ask for more water over and over, and at night always wanted water; one night I noticed that she asked for it three times in a half hour, though not feverish. The demands of little children, night and day, for water, fairly try the patience of those in charge, and it is probable that for health and growth they need more water than it is easy for an adult to realize. The evaporation from their skin (Prof. Le Conte suggests to me) is much greater than from ours, owing to its soft and porous texture.

3. Nausea.

Preyer seems to have found no evidence of the existence of nausea in the first three years. My niece showed it distinctly several times. On the few occasions in the earliest months when

regurgitation of food occurred, it is true, there was not the least sign of nausea. But in the tenth month (299th day) the mother, chancing to be where there were some pleasant warm sulphur baths, took the baby into them. Shortly after, the baby was taken with every appearance of violent nausea, with vomiting, which recurred all day. No other instance occurred till the eighty-first week, when vomiting was caused by some green fruit, with the skin: nausea seemed to accompany this, and the next day when the child was asked where she was sick yesterday, she placed her hands at once on her stomach, then doubtfully on her chest and around her sides, toward her back. Asked a second time, she placed her hands as before, first decidedly on her stomach, then hesitantly backward. No one had told her anything about the location of the trouble, and she evidently recalled and correctly located either the nausea or the muscular sensation of vomiting. In the eighty-third week she was again sick several times; and this time she announced the nausea each time before vomiting by running to her mother and crying, "Baby sick!" — an unmistakable evidence that she understood and named the feeling. The next day, asked where she had been sick, she said "stomach," and put her hand on the right place.

Three times in the third year she suffered similar small upsets from indiscretions in eating; the second time (thirty-third month) it left her droopy and sleepy, an effect that had not been seen before. In the last week of the thirty-fifth month, she had a bad fall which caused a slight concussion of the brain: she was somewhat nauseated at once, and after an hour became very sick, and vomited, then sleepy; she could not be persuaded to eat, but drank a little milk; next day, she would eat only a little toast, and did not wish her breakfast, — but these effects were of course due to other causes than the simple nausea.

4. Other Organic Sensations.

The child repeatedly choked a little in nursing in the first six months, and once or twice when she had kicked from her mother's hands in the bath and gone under water; but she showed no sign of especial fright or discomfort. In the seventy-eighth week, however, she choked on a bit of candy; and though she succeeded at once in raising it from her throat when told to "spit it out," she

found the sensation alarming and distressing while it lasted; began to cry as soon as she felt it and showed considerable relief when it ceased. In the 87th week, choking on a drink, she merely remarked gayly, "Too mu' g'l!" Too much drink.)

Except in going under the water a few seconds, and in difficult breathing from a cold, the sensation of suffocation was never experienced that I know; but it is quite possible that some such sensation, coming from disturbances of respiration, may cause the unaccountable crying of babies, especially on waking from sleep, as it has to do with the vague horror experienced in nightmare with us.

The single note I made of organic pain (colic) has already been given (Pain, p. 154, footnote).

GENERAL SENSATION.

1. Sensations of Well-being and Discomfort.

Professor Preyer intimates¹ that in the first months the infant must experience a larger proportion of unpleasant than of pleasant sensation. This does not accord with my observation; and the opinion of the best nursery authority I have consulted is emphatically to the effect that if a healthy baby is not in the main a happy one from the first, the care it receives is at fault. But there are certainly individual differences between babies, some of whom appear, under conditions of general health and comfort, to experience a lively felicity, and others a merely neutral feeling. So, too, some babies are less troubled than others by actual discomforts, and recover from them promptly, instead of seeming for some time afterward affected by disagreeable reverberations.²

In the case of my niece the underlying condition of sensation seems to have been usually agreeable. It is true that in the first week or two, besides some fretting for special reasons (as hunger, or slight touches of colic), a vague discomfort, not enough to cause fretting, sometimes appeared (see p. 180, above); while positive expressions of comfort were not noted, — her prevailing feeling, to judge by her face, being quite neutral. But with the second week,

¹ "The unpleasant feelings predominate until sleep interrupts them."—*The Senses and the Will*, p. 143.

² There is room here for interesting speculation on the connection between temperament and idiosyncrasies of general sensation. We may surmise, for instance, that a happy temperament, heeding discomforts slightly and recovering from them quickly, is due to a constant undercurrent of agreeable general sensation, which modifies disagreeable special sensations, and quickly regains dominance in consciousness, obliterating any faint remnants of discomfort; that the converse is true in the case of a melancholy temperament; while a temperament that feels *both* pleasure and pain strongly and, so to speak, with the whole consciousness, is one in which the undercurrent of general sensation is for some reason unstable, and instead of modifying the force of special impressions, is readily deflected into the same course with these, strengthening and prolonging them.

the grimaces of vague discomfort disappeared, and an expression of great contentment became apparent when the baby was warm, dry, fed, and wide-awake. It is worthy of note that this expression of positive content appeared in close sequence after the habit of staring at bright surfaces, as if the material, so to speak, for the diffusion of agreeable general sensation began with the action of the special senses. From this time on, while there are daily notes of fretting for this or that, there are also daily notes of visible contentment and well-being. The first true smiles (latter part of the first month) were expressions of this general comfort, not of special pleasure; and with the second month, happy sounds began to be uttered at these times of contentment. Up to the eighth week, there was always a good deal of vague movement of limbs and head (see p. 180, above) at such times. I have noted above the suddenness with which in the second month the pleasant mood gave place to fretting.

Activity of attention and interest was heightened at times of general well-being, so that it now became hard always to discern whether the joy displayed was due to the sense of well-being itself, or to pleasure in the objects of attention. Already, in the second month, when lying warm, fed, and altogether comfortable, the baby took great interest in the faces of those bending over her, and smiled at them in much gayety. In the third month her perpetual desire to be sitting up interfered with moods of contentment, till it was gratified; then she would sit happily, propped with cushions, many minutes at a time, playing with a rattle and crowing. In the fourth month (especially when propped in her high-chair at table, where the lights and the rattling of dishes supplied additional stimulus) the faces and voices about her made her display the most vivacious delight, with smiles and movements, cooing and crowing. In the fifth month pleasure in faces and voices clearly excited expressions of joy oftener and more intensely than the mere sense of well-being. Yet I find a good many notes, in the fourth and fifth months, of similar jubilant behavior when she lay by herself on bed or floor, kicking, crowing, smiling, and murmuring, delighted if paid attention to, and happy if not. As a rule, some occupation, something to handle and look at, was necessary to contentment, — at least a rattle to flourish and to put into her mouth: but I have notes of

two instances at least when she lay in bed, perfectly quiet and happy and wide-awake, quite alone and unoccupied, for a long time, saying "agoo" peaceably to herself, smiling when I bent over her, but content to lie still as she was. This placid contentment, however, was now rare, and active jollity more common.

Throughout the rest of the first half-year my notes record, over and over, her moods of "jollity," "perfect content," and "high spirits." The 138th day I speak of jollity as the baby's normal condition; and such notes recur constantly as, "In highest spirits all breakfast time, laughing with glee when any one smiled or spoke to her;" "Very happy, smiling about and murmuring;" "Lay looking at us and uttering contented murmurs;" "Exceedingly jolly, smiling, kicking, and sputtering;" "In highest spirits, frequently giggling, — if her mother pointed a finger at her and said, 'O Ruth!' she would giggle." A characteristic of this condition of spirits seemed to be that she was easily "set off" into merriment by a word or touch. I noted this first about the end of the fourth month, when smiles, or even laughter and joyous movements, could be coaxed at almost any time, in these sunny moods, by a few caressing words and touches; and the same thing will be seen in the notes below, in later months.

In these moods, also, the baby was apt to coax for a frolic. The connection between general joyousness of mood, and joy in muscular activity and in motion (spoken of quite fully above), was close, and it was not always easy to tell which inspired the other.

Throughout most of the second half-year, also, my notes read, day after day, "Rolls about by the hour on the floor, kicking and crowing;" "Very happy all day, rolling about the floor, kicking and prattling;" "Especially happy most of the day, answering with laughter when spoken to." Besides the pure joy in existence that seemed to fill her, her pleasure in her own increasing freedom of muscular action and sense activity, her delight in motion and frolic, seemed to fill her days with an exuberant joyousness. Laughter, shouts of joy, overflowing ejaculations of happiness, delight and pride, deep and happy interest, are constantly recorded in connection with special pleasures, such as the use of her own bodily powers, exploring and investigating, the more varied dietary of the latter part of the year, the daily reappearance of friends after

absence, etc. Most of the time, she wanted to play instead of sleeping or eating.

In the last two months of the year, notes of a general joyousness, apart from specific pleasures, diminish. The baby's appetite was not good in the eleventh month, and her health was not perfect; still, the absence of notes of general joyousness seems to be due not so much to any real lowering in the level of her spirits, as to the fact that her increasing power of occupying herself was so filling her time with special pleasures that her merriment was all credited to these. She would play about on the floor with frequent little shouts, crows, squeals, and babble of joy; she rejoiced to go from one room to another, shouting and calling; her ecstasy when taken out driving is described below in connection with the love of outdoors. In the twelfth month, as she became still more absorbed in her play, there was an increasing seriousness of curiosity and attention, and a corresponding decline of gayety.

In the second and third years mere physical gayety was more and more obscured by the increasing complexity of the child's occupations and interests; and my notes also, being more and more taxed with phases of mental development, fail to keep as close record of physical conditions as in the first year. Few months pass, however, without notes of the liveliest gayety: the child would run about with joyous little cries, prattling, singing, breaking into occasional small shouts and capers in sheer exuberance of spirits, jumping, racing, tossing her arms, and in every way showing the utmost physical joyousness.

Of general moods of depression breaking this level of high spirits, I find little mention, apart from evident physical indisposition, or from the conditions attending sleep (see below, pp. 261, 279). The first instance I find is on the 57th day, when the baby was very silent, looking soberly about, and fretting to be held sitting. An episode of apparently causeless discontent in the fifth month (137th and 138th days) proved to be due to insufficient nourishment (p. 217). Once in the sixth month (173d day) I find the note, "Well and happy, though not in overflowing spirits, as some preceding days; only quietly pleased at frolics, and did not want to be laid down to kick." For about four days in the latter part of

the eighth month, she was sober, and did not roll and rollick as much as usual; she laughed and played a good deal, but the perfect joyousness was tempered. One of these days was cold and drizzly, and she was kept in the house, which grew close; at last I wrapped her up and took her out, and she came back with all depression dissipated. Half a dozen instances of more decided general discomfort are noted (fifth to eleventh months): for several hours she would be restless, fretful, ready to cry on slight occasion, and would demand attention and diversion constantly. These instances all occurred within the first period of dentition, (which was also that of gradual weaning,) and in at least two cases the connection with dentition was evident: once, in the sixth month, the baby had been restless and fretful on two successive afternoons, and by evening had cried hard unless constantly diverted, but from the hour the tooth (the first one) came through she was happy and smiling; and again in the ninth month there was an immediate return of good spirits after the appearance of a tooth. In neither case had there been any evidence of local pain before the cutting of the tooth, but rather of a general discomfort. It is likely that there really was local pain, not localized by the baby; even grown people find it hard sometimes to locate a dull pain: but the general disorders that sometimes attend teething, show that there may easily be very diffused states of uncomfortable sensation at this time. The few remaining instances of fretfulness preceded the appearance of teeth by sufficient intervals to be referred to early stages of their growth: it is an old doctrine that there are two periods in the growth of each tooth when it causes distress, the first when it starts to push up from the bone, the second when it is about to break through the skin. Still, most of the teeth appeared without any disturbance of the baby's spirits that was marked enough to get into my notes.

In the second and third years, also, I find only four times a note that the child is fretful and exigent, contrary, or easily grieved, when she seems perfectly well; and on two of these occasions a failure of appetite indicates the connection of the mood with obscure physical derangements. Beyond this, "bad days," "getting up wrong side of the bed," etc., do not occur. There were long periods (to be spoken of presently) of a perceptible lowering in the

level of spirits, without falling below that of cheerfulness and a general habit of enjoyment. Other variations of mood had a clear relation to physical disorder, — in a few cases, to slight digestive disturbance, but oftenest, as in the first year, to dentition. The cutting of a tooth was apt to be preceded (though not always) by perhaps a half-day of fretfulness and general sensitiveness, — which in two cases disappeared, just as I had twice noticed in the first year, *immediately* on the appearance of the tooth, and was followed by a mood of positive joyousness. One of these instances was in the eighteenth month: the child was in the morning unusually exigent, and in the afternoon fretful, especially as it was drizzly and she could not go outdoors; she begged hard and persistently to go, and could not easily be diverted. Thinking to interest her, I showed her her crib and chair, moved out on the veranda in the process of house-cleaning: instead of being pleased at the novelty, however, she was greatly distressed over the exile of her belongings, and was only kept from wailing over the dismembered crib by seeing her chair, at least, rescued from the miscellany of furniture and brought to her. After dinner her mood changed suddenly: she was jolly and happy, ran about in great spirits, uttering many inarticulate exclamations of happiness, and asking no attention, and took lively and pleasant interest in the re-laying of carpet and replacing of furniture, rejoicing especially over her crib. It proved that a tooth, a molar, had come through the skin late in the day. Again, in the nineteenth month, she had for a day or two showed some crossness, but immediately after the appearance of an eye-tooth had a fit of the highest spirits, running about with joyous little cries, capering, shouting, scrambling on the lounge and off, in irrepressible glee, which remained her general mood for at least four days. In a third case (nineteenth month) the cutting of a tooth was followed on the *next* day by a fit of wild spirits. The child had a good many colds in the two years; but I find only four instances in which peevishness or languor is associated with one, and a dozen in which her excellent spirits, in spite of a severe cold, are mentioned. Thus in the latter part of the twenty-fifth month, she had a tenacious cold, which did not affect her spirits appreciably for some days; then, having one day a little more cold, she became

very irritable, and whimpered because her dress sleeves did not come down as far as her shirt sleeves; because her hair was brushed back; because her mother instead of aunty put her bib on; etc. The next day, though the cold continued and she had no appetite, she was sunny and happy all day; nor was there any recurrence of the peevishness in several days more that the cold lasted, though she visibly suffered, in color and appetite, from its long continuance. In the twenty-eighth month, during the severest cold and cough she had in the three years, I note one day that she is not seriously affected in spirits; the next that she is in lively spirits, singing and prattling about her play; the next that she was ill-behaved at dinner, and cried when reproved, and this was the night of the fit of unreasonable crying described below (Sleep, p. 289).

There were, of course, continual special grievances to interrupt the high level of happiness. In the first year there were bumps and falls, deprivations, the great standing affliction of being dressed, etc. But these troubles were few in number compared to the pleasures; and it is quite striking to see with what ease the baby recovered from uncomfortable feeling. In the first five months, though she took pleasure in objects to see and to hold, she showed no grief at their withdrawal, and her mother would unceremoniously take a thing from her hand and lay it aside in a way that would have brought an inconsolable wail from some babies; but this one would merely look surprised or troubled for a moment, then reach for something else. In the twenty-third week, for the first time, she nearly cried several times at having things taken from her, or being interfered with while she was playing with them; and in the next week she was bitterly grieved at such an incident, and cried till her eyes were red: these were the sole instances in the first six months, so far as my notes show. In the next half-year I find three or four instances every month of crying, sometimes bitterly, over disappointment, or withdrawal of something enjoyed. The first week of the ninth month I have a general note that she usually cries for a few seconds — till diverted — when anything is taken away that she specially likes. As a rule, she gave things up easily, and turned her attention to something else. *E. g.*, in the eleventh month (315th day) I had the camphor beside me on the lawn for instant application when mosquitoes attacked her, and she was very desirous of

the bottle, and crawled round and round me after it; I was busy with writing, but kept an eye on it, and removed it from under her grasp just as she reached it, again and again, — which she seemed to regard as a play, and took in perfect good nature. When she was hurt, bumped, or startled, she recovered her composure very soon. In the ninth month, her locomotion having now proceeded far enough to cost her constant bumps, she would as a rule look surprised and sober for a few seconds, then forget the matter; a few times, there was lusty crying. In the tenth month she paid no attention to slight bumps, but cried vigorously over hard ones. In the twelfth she hardly passed a day without a bump, and sometimes cried hard over one, but was easily diverted.

She suffered scarcely at all from timidity. With strangers she was as a rule happy and sociable, and ready to respond with great gayety to advances toward a frolic. In the ninth and tenth months she suffered a little from timidity toward strangers, and she had a few frights from severe falls and other causes; but on the whole her absence of fear, either of persons or things, was noticeable. She was not easily startled, and novel sights or sounds excited a pleasant interest instead of fear.

Throughout the second and third years the increase in number and force of desires increased not only the child's pleasures, but also her disappointments. There was also an increase of self-will, and in the third year, especially the latter part of it, there was much disposition to resist constraint. There was therefore less easy surrender of her wishes, and notes occur from time to time of crying over refusals or deprivations; hurts too were sometimes loudly lamented. But in the main it continued true that the child threw off disagreeable feeling readily and took nothing very hard; accepted denial reasonably; would let a thing be taken forcibly from her hand with little protest, and was easily diverted. She was always patient and cheerful in waiting for a promised pleasure, dwelling on the pleasant prospect, not the delay. "Ruth has had one peach," she would be told, "and must not have any more now; another day." — "Yes: Ruth have peach another day," the child would answer contentedly, and trot off to her play (twenty-second month). The day after her severe fall and concussion of the brain, she seemed bright and natural, only a little sober, and was unexpectedly

little troubled by her bruises (though tired toward evening, clinging to her mother and crying); and by the second day the bruised lip was recovering with surprising rapidity, and her spirits were excellent. No nervous effects were ever visible from the accident. Anger and fear (though, especially in the second year, there were some episodes of timidity with people) troubled her very little; and specific pleasures far outnumbered specific grievances at all times.

A mood more common than depression or irritability was one of rough boisterousness. This I noted but once in the first year, in the twenty-eighth week, when the baby took up a sort of riotous behavior and became very noisy, with loud, hoarse shouting, and rough laughing, "haw-haw," — which at first I took for an expression of discontent, but which proved after a day or two to be good-natured. One evening in this week she sat on the table just before bedtime, shouting, ho-hoing, and reaching with snatches in every direction, as if she could not keep still, — spilling over with riotous excitement, till her gentle grandmother said, "Why, you little rowdy!" In the next week this noisy behavior disappeared, giving place to a more tempered, yet more joyous merriment. The first instance of a similar wild mood that I record in the second year is at nineteen months, when the child was one evening in boiling-over spirits, especially disposed to do forbidden things, — twitching the table-cloth, *e. g.*, to the risk of lamp and dishes; she would dive with an air of triumphant mischief at her grandmother's glasses and cap, and jerk them off before a hand could be quick enough to stop her. Some roguishness often at this time — twentieth month — entered into her fits of wild merriment, usually showed by running laughingly away from us, but sometimes by seizing at our hair (see *Muscular Sensation*, p. 190). In the twenty-first month she tried repeatedly to see how far she could go safely in roguish naughtiness, — shouting and squealing at the table, throwing her hat out of the buggy, *e. g.* In one fit of wild spirits, at twenty-one months, she scrambled defiantly on the table at the close of a meal, and seized on the salts; scampered about laughing, impatient if held still a moment; and refused to kiss any of us good-night, laughing and romping instead. I note over and over in the third

year that her naughtinesses are almost entirely pure overflows of rowdyish spirits, — such as throwing her plate across the table, (twenty-fifth month,) banging the furniture with sticks, gayly assaulting us or the cat. In the thirtieth month I note that much of the time the child seems unable to contain her animal spirits, running over with desire of noise and motion, yet does not laugh a great deal, and is rather noisy than merry. In the thirty-third month, the mood seemed still more clearly differentiated from real merriment: there was a boisterous, spilling-over air about her, that kept her kicking this, putting her foot on that, in a naughty way, — not investigating, but a stupid and aimless expenditure of nerve surplus, which seemed to unfit her for occupation, rather than to show a craving for it as an outlet; when in such a mood she would not be held to any occupation, but was restless and wilful. She had a habit at the time of moving a leg about or teetering on her feet almost constantly, without any reason that I could find. It seemed nervous and not normal; and I have seen the habit in an exceedingly nervous grown person; but the child seemed in perfectly healthy condition.

In the rough gayety there was little natural and joyous laughter: indeed, in the thirty-third and thirty-fourth months I noticed the infrequency of genuine laughter, and wondered if it was because the child's association was so entirely with grown people; she seemed to wish to laugh, and to try to work herself up to it, but it was forced. In the latter part of the thirty-fifth month I speak of the return of a habit of joyous laughter.

From what sources, physical or psychical, these moods came, I found it impossible to guess: they seemed to be essentially a part of the child's temperament, and in a modified form, they persist as she grows older. Although it was not possible always to draw the line between the outbreaks of boisterousness and those of pure merriment, — for they shaded into each other, — they were nevertheless different things; and I have seen no reason to think that there is any gain to the joyousness of childhood from indulging the boisterous tendency, (often seen in untrained boys,) nor should it be confused with genuine high spirits and romping glee.

Up to the 56th day, so far as my notes show, the general mood

of the baby was the same from day to day, (and apparently of a neutral character,) brief fluctuations occurring within the day. On the 56th day I find the first mention of a mood as characterizing the whole day: the baby is on this date recorded as singularly bright and sunny "all day long," smiling at every one; the next day was a sober one; and after this I find over and over notes of moods that lasted all day, or day after day. In the second and third years I find sometimes noted mere ebullitions of gayety, lasting perhaps an hour or two; sometimes that the child was spilling over with jollity and activity "all day;" and sometimes for weeks at a time her uniform physical well-being and overflowing spirits, her racing, capering, squealing, all day long and day after day, are remarked on; or perhaps like periods of soberer mood. In analyzing these notes, it becomes evident that there were long waves of variation in mood, within which occurred the shorter waves, those of a few hours or a few days, which were usually quite clearly referable to physical condition. The longer waves were more obscure in their origin, and more imperfectly noted; and I have tried in vain to find any consistent process of development underlying them. The following periods seem fairly clear in my record:—

In the first three months of the second year the child's prevailing mood seems to have been rather of serious happiness than of gayety, her increasing powers of locomotion and understanding opening up mental interests that waked all her curiosity and absorbed all her attention. There was more of mere merriment in the sixteenth month, but somewhere about the beginning of the seventeenth a vague decline in spirits was perceived,—a loss of the expression of bright and winning interest from her face, and of the habit of frequent smiles and laughter; the expression of her face became prevailingly dull. This phase may have had something to do with dentition, but it was in the eighteenth and nineteenth months, not the seventeenth and eighteenth, that dentition was proceeding most rapidly. A phase of most marked and demonstrative joyousness began about the last week of the twentieth month, and may mark the close of a period of dentition; or complete recovery from colds with the settled warm weather (June); or a stage of especially vigorous circulation, due to the development of the powers

of movement; or less obvious causes. Her even nerves, perfect physical condition, and freedom from timidity, are expressly noticed at this time.

With the last week of the month, and until near the end of the twenty-second, appears a condition of being "not quite in her usual spirits," — not fretful, but less busy and satisfied; she seemed often bored for want of occupation, restless, desiring occupation, but unable to invent much. I was disposed to attribute this mood, which recurred in the twenty-fifth, thirtieth, and thirty-third months, to psychic causes, thinking the time had come when her spontaneous activities were not enough, and she needed more guidance in her play, — that the occupations of her own devising were too simple and monotonous, and she desired more interesting ones, supplied by us. But in the intervals between these phases of restlessness I find, on the other hand, notes of increasing ability and disposition to occupy herself. It is evident that it was a complex matter, in which increasing mental demands and increasing power of self-occupation kept pace but irregularly; and general physical mood came in as a factor, for when the child was in a state of high well-being, interest was easily roused by slight things that in other moods did not suffice. Another form of this same variation in mood as indicated by interest, was that at times the child was more fickle and inconsecutive in occupation than at other times, no one thing having power to interest her long. After this mood in the twenty-second month, with gradually increasing gayety through the twenty-third, the twenty-fourth seems to have been a month of exuberant happiness.

In the third year, there was a good deal of alternation, periods of restlessness and dependence in attention alternating with others of advancing power of self-occupation, and periods of boisterousness with others of real merriment, lasting from a few days to two or three weeks; but my notes do not define these periods with much clearness, nor give clue to their causes. The twenty-seventh month, however, was one of lively gayety, while from the thirtieth there was a vague diminution of spirits and increase of the rather joyless boisterousness above described. During much of the thirty-fourth month, the child seemed quieter, did not jump or shout much, said it made her tired to run, was

willing to sit in our laps, or even sought them, though she seemed perfectly well. Before the end of the thirty-fifth month the bright and spontaneous gayety reappeared, and so to the end of the year. Whimsical, noisy, and rather rowdy fits still occurred, — freakish ebullitions at table, *e. g.*, — but on the whole the child was charmingly pleasant, gentle, and joyous in these closing weeks of the year.¹

Some other peculiar states, apparently due to a more than normal intensifying of pleasurable general sensation (besides the psychic elements) are mentioned below (p. 258) in connection with their effect on sleep. Notice especially the physical effect pervading the baby's whole body after her excitement over callers, — making her alert throughout, wanting to jump and dance. Other peculiar states attending the approach and disappearance of sleep, are described below also.

From the first, the bath (34° C.) seemed to have a marked effect in producing a heightened sense of general comfort, and caused an expression of great satisfaction, even in the earliest days; muscular activity, and also the tension, or tone, of the muscles, was at the same time increased. These effects were doubtless due to more rapid and well-distributed circulation. In the fourth week, when in the bath, the baby would open her eyes very wide, and hold up her head more stiffly than at other times, while the asymmetry of her eye movements and the aimless waving of hands and arms increased. In the second and third months, she propped herself strongly with her knees and pushed with her feet in the bath. Asymmetric eye movements continued there (fifteenth week) after they had disappeared under all other circumstances. The baby did not smile nor utter sounds in the bath, but had an air of almost eager, though quiet pleasure, — eyes stretched wide open, rapid breathing, head held up, feet pushing (second month); in the sixth month (the bath now about 32° C.) she still enjoyed it without hilarity, but with much quiet pleasure; in the seventh she began to show hilarity in the bath, splashing with her arms; in the eleventh she would stiffen in resistance to being taken out. It was at all

¹ See a rougher analysis of these phases, which passes over some of the briefer alternations, on pp. 89, 90.

times, and remains at seven years old, with I think not a single exception in her life, a most exhilarating pleasure; was invariably desired (with the single exception that she once in the nineteenth month cried and resisted at being brought in from outdoors for her bath), and reluctantly quitted. In the twenty-fifth month she once urged her wish to stay in forever: "Ruth won't go come out any more!" Throughout the second and third years, she prattled and played in the bath, with shouts, squeals, and joyous inarticulate sounds.

The effect of undressing and rubbing with oil, a daily practice in the early months, I have spoken of above (p. 182); and also have mentioned that this rubbing sometimes changed the baby's whole mood, — as on the 88th day, when she had been fretful all the afternoon, but became happy and smiling after being undressed and rubbed; so again the 177th day.

The child was much in the open air, and most of the time from the fifth to the tenth month the weather was most favorable. She did not in the first six months appear especially affected in general sensation by the outdoor air. The first time she was taken outdoors, in our arms, 29th day, she showed no especial pleasure; and though from the next time, 38th day, she did show deep pleasure when taken out, this seems to have been due in the first place to the motion of the baby-carriage. Late in the seventh month (202d day) her grandmother took her outdoors (bareheaded for the first time) and sat quietly down on the veranda with her saying she wished her to learn to love the outdoor air and sunshine, the trees, and flowers, and birds, without needing the baby-carriage and its motion. The baby seemed for the first time taken possession of by that joy in *outdoors* that afterward was so strong. She sat in her grandmother's lap with murmurs of delight; and thereafter her joy in lying on a blanket and rolling freely about was greatly enhanced if the blanket were laid on veranda or lawn. Within two weeks, she would coax to be taken outdoors, and then coax till she was put down out of arms and left to the enjoyment of her own perfect bliss. In the following months my notes run: "Great joy in playing on a quilt on the lawn, — sat laughing and ejaculating with pleasure;" "Extreme joy in being allowed to sit and crawl on the

lawn, — incessant cries of joy and laughter as she looked about, at the trees, etc., up, down, and around, — happiness overflowing for some hour and a half, till she was taken away." By the eleventh month, to go outdoors was the great joy of her life, coaxed for daily, and hailed with crows, prattle, laughter, and movements of the body; in driving, the baby would nestle to one with murmurs of joy, utter small shouts and joyous syllables, lean to look about, clap or wave her hands, smile and look up in our faces.

Throughout the second and third years even more than in the first, to be outdoors was the great condition of buoyant states of feeling. Her desire to go out, her grief in refusal, her exceeding joy in going, her happiness outdoors, her reluctance to come in, are the subject of endless notes. Much of her emotional expression was developed in connection with this most intense and constant of her desires and joys. In the thirteenth and fourteenth months, *e. g.*, she would coax all day to go out, going to the window and pointing out, to the door and prying at the edge, to the chest where her bonnet was kept and tugging at the lid, to us and begging with all her arts; when asked if she wished to go, she would nod and give cries of assent, breaking into joyous laughter, and when she saw movements toward getting her wraps or opening the door, the laughter, springing, and cries would increase; when brought in, she would cry and beg tragically, "Go! go! go!" (eighteenth month). In the periods of dullest spirits, it was scarcely ever that she was not happy and able to occupy herself outdoors; while in the happiest period she was occasionally a little fretful if kept indoors. The ebullitions of intensest joy and activity were when running about outdoors: *e. g.*, 627th day, as she played on the lawn, it did not seem possible for her to get expression enough for her spirits, — she ran, whirled around, shook herself, squealed, laughed, and raced vigorously this way and that.

In this enormous effect on the spirits, the greater abundance and novelty of objects of interest did not (apart from the dog and other animals) seem to have much part, for she did not seek their resources much: she sometimes explored, but most of the time her outdoor occupations were simpler than indoor ones, and no more novel, — she sometimes trotted about by the hour, purposelessly enough; she often picked flowers; she dug in the ground a great

deal; sometimes she simply ran along the garden walks, tossing her arms and exulting. She repeatedly begged to leave a novel house, full of objects of interest, to "walk outdoors," though there was no more than a board walk and a few weeds and grasses there to interest her. Even in the first year, I did not think that the novel sights and sounds had much to do with her outdoor joy, for a large collection of interesting things to see and hear, in a room, never produced the same sort of unconcentrated, incurious joyousness. Nor could the wider spaces have affected her much in the first year, since distant seeing was not yet acquired (see *Sight*, p. 20). At this time, I thought that the mere physical effect of the fresh air, together with the brighter light, and perhaps the moving and playing of the lights in the leaves, must make up the main part of the pleasure. In the second and third years, the freedom from walls and bounds, the larger visible spaces, the brighter colors, the movement and rustlings in the trees, the outdoor sounds, seem to have made up a joyous medley of sense-impression that overflowed in a highly-diffused exhilaration. The condition seems akin to the joy of birds; and there seems no reason to doubt that it is an early stage of true "love of nature." The love of outdoor freedom is strongly hereditary in this child's case: her remoter ancestry, as I have mentioned, (p. 5) was mainly of seafaring or farming folk; and no other trait is common to so many of her kindred in the generation or two before her. Whether it is any more marked in her than in other children, however, I do not know: nothing is a more invariable observation in every nursery than the passion for outdoors.

2. Sleep, and Attendant States of Sensation.

[For purposes of intelligible record it is impossible to separate the subjects named above, although it is evident that Sleep, a physiological condition, lies quite outside the subject of Sensation. It is attended, both in coming on and in passing away, by characteristic states of general sensation, and also by one distinct sensation, — that of sleepiness, — recognized in consciousness as unlike any other, and somewhat localized, being referred vaguely to the head, and especially to the eyes.

Something must be said, also, as to the classification of Fatigue,

which Preyer makes a separate head, under Organic Sensations. The word *fatigue* is used of several feelings, which fall in quite different categories of sensation. Muscular fatigue is a distinct sensation, easily localized when the activity that produced it has been local. It is plainly a correlative of muscular activity, and I have already entered my notes concerning it under the head of Muscular Sensation. There are also the somewhat complex feelings of fatigue, dermal, muscular, organic, and vascular, which I have placed above under the head of Sensations of Position, though they might perhaps be held to belong to general sensation. There are also states of completely diffused sensation originating in excess of nervous action, usually of the special senses, with some accompanying cerebral excitement; and these I class in the present chapter, the more as their relation to sleep was especially noticeable. Unlike the others, they are not always, or usually, feelings of lassitude, but rather of increased excitability, and the word fatigue would not be used in naming them unless the excitability had passed on into the irritable condition that we recognize when we say we are "nervously tired." Fatigue may be, again, purely cerebral, as when the attention is wearied, and in this case there is no sensation at all. In scientific discussion the physiological condition that causes all these feelings is almost always meant when the word is used, not the feelings themselves.

The word being used thus comprehensively, and the condition of fatigue being one that attends (with or without resulting sensation) *all* activity, I have made no separate category of it, but have distributed my notes of the different types of fatigue according to what seemed their simplest relation in the actual occurrence of the incidents.]

The duration of sleep in the early months was quite different in the case of my niece and in that of Preyer's child. Instead of beginning with short periods of sleep, 2 hours in the first month, and gradually increasing up to 6 or 8 hours in the sixth month, my niece had her long periods of unbroken sleep in the first two months, and shorter ones afterward. From the first week, she

¹ This does not ignore the fact that, as several psychologists have shown, there is *also* a faint diffusion of fatigue through the body after local activity.

often slept 6 hours at a stretch, and 7 hours was not unusual in the second month; once (58th day) she slept 8 hours continuously; and at two months old (63d day) she once slept $9\frac{1}{4}$ hours.¹ After the first two months, I found it impossible to keep close account of the duration of sleep; but the general indication of my notes is that the periods grew shorter, as habit established itself in the nursing. Until the second quarter-year the baby slept a good deal of the daytime, in several naps; but now the daytime sleeps decreased, and two naps of an hour and a half each, morning and afternoon, (with, in the fourth month, one or two brief dozes besides,) became the rule until near the end of the first year. At night she slept about 11 hours, broken by two intervals of nursing. Now and then a nap in the daytime extended to $2\frac{1}{2}$ or 3 hours, and now and then she refused one nap altogether. Not infrequently she slept past the midnight nursing, making seven or eight hours of unbroken sleep; once, in the twelfth month, although she waked for milk at midnight, she slept until 9 A. M., three hours past her usual time of waking.

By the end of the first year it became difficult to coax two naps in the daytime, and in the thirteenth month one became the rule. Even when she seemed very sleepy, it would prove impossible actually to get her to sleep. The naps seem to have become shorter and lighter, also, though my notes are insufficient on this point; I have one note (nineteenth month) of a nap of four hours. There were a good many days when the baby refused to sleep at all; I find one note of four days in succession without a daytime nap (twenty-first month).

In the third year, the daytime nap grew harder and harder to

¹ The first of these long sleeps (37th day) illustrated the decrease of depth of sleep in its latter hours. She fell asleep at 5 P. M., though it was then nursing-time, and slept deeply till 9 o'clock. On later occasions of prolonged sleep the mother, finding that no harm came from postponement of nourishment, let the baby sleep as long as she would; but this first time she waked her when the interval since nursing had reached six hours. The baby nursed and dropped at once into deep sleep again, and slept till midnight, when she was again fed (my note does not say whether she waked voluntarily) and dropped again to sleep; but though earlier in the night she had slept so soundly that hunger could not wake her even at three times the ordinary interval since she had been fed, she now, though fed and comfortable, slept lightly, and waked three or four times before morning.

induce, and more irregular; at this time, too, her mother was obliged to be often absent from her, which increased the difficulty; and after the twenty-sixth month, the regular nap was given up. She not infrequently fell asleep, however, when driving, or traveling on the cars, and several times when ailing took short naps. Meanwhile, in both the second and third years, the sleep at night was usually about 10 hours (8 P. M. to 6 A. M.), sometimes broken once or twice. In a few cases in the third year this was prolonged to 11, and once (twenty-seventh month) to 13 hours.

Opportunities to observe the effect of peripheral stimulus during sleep were small. As far as sounds were concerned, the sensibility was slight in the early weeks, and it was not till the last week of the fourth month that voices and movements about the baby were apt to make her restless in sleep. The rustling of paper, however, (the nurse told me,) repeatedly made her start and cry as early as the 3d or 4th day, both when asleep and when awake; and on the 6th day I heard her cry out in her sleep at the sharp tearing of paper. I noted once in the twelfth month (243d day) that she waked every time her father rustled a paper.

In the following months her grandmother thought her rather easy to waken, as compared with other babies: still, she was not wakened in the evening by the talking and reading aloud that regularly took place in an adjoining room, separated by a portière only from the one in which she slept; and several times she slept on the cars without being perceptibly disturbed by the stopping and starting at stations, the coming and going of people, nor even the brakeman's calling of stations and slamming of doors, unless she were near the end of the car.¹ Like most babies she could be lifted, carried, and laid down, without waking, if it was carefully done: her sleep in these earliest years, however, never approached the insensi-

¹Whether in response to sensations, as weariness of one position, weight of bedclothes, etc., or from central causes, she has since the second year (like most children) shown a great deal of muscular activity in sleep. In the last week of the second year, I slept with her, and noticed the remarkable restlessness with which she rolled about in all imaginable positions, *e. g.*, across my breast and neck, or with her face lying on my ear, etc. All this was habitual, her mother assured me. When she slept beside me in the third year, it was not quite so marked.

bility to external stimulus that characterizes it now, at seven years old, when the child can be taken out of one bed and tumbled into another quite heedlessly without disturbing her, and has to be spoken to over and over and handled rather roughly if it is necessary to rouse her out of a deep sleep. By the middle of the third year, (and ever since,) flea and mosquito bites disturbed sleep badly (see *Dermal Sensations*, p. 150).

In light drowsing the condition of sensibility was quite different. Once in the eleventh month (309th day) I note that though sleepy she could not get to sleep on the cars, rousing at each station from the doze into which she was sinking, disturbed by the change of motion. If she went to sleep in one's arms it was necessary to wait till sleep became deep before laying her down. There may have been in light half-sleep an even heightened sensibility to the changes of motion, as there was to sound in the incident of her being startled at the rattling of the tin bath-tub handles on the 37th day (see *Hearing*, p. 108); she was never thus startled by any sound when awake. For *discriminating* sensibility, her senses were doubtless dulled in this condition of half-sleep, as older people's are. Thus in the last week of the second year she came into her mother's bed before light, and half-asleep, rolled over to me as I occupied her mother's usual place, and though she touched my face and hair with her hands, did not discover till daylight that it was not her mother. See also instances below of clearness or confusion of senses just *after* waking. References will be noticed below, in other connections, to her apparent consciousness sometimes, even when half asleep, of our movement, — clinging tighter, *e. g.*, if I moved, when she had gone to sleep clinging to me, — automatic probably, under continuance of the suggestion given by her waking fear that I would leave her.

Organic sensations — or conditions — affected the duration and depth of sleep considerably, as well as the ease with which it came on. The satisfaction of hunger favored sleep, and it was a daily practice to go to sleep at the breast: yet, as has been mentioned above (*Hunger*, p. 215) hunger did not always suffice to prevent sleep, nor to break it. Sleep was apt to be deeper and longer in the open air, and when the weather per-

mitted the baby often had her naps outdoors. She was far more easily put to sleep in the open air all through the first and second years; as this was always in her baby-carriage or on a drive, the motion may have been the chief reason, but pushing her about in the baby-carriage inside the house did not have the same effect. At the end of the ninth month (271st day) she slept peacefully an hour and a half on the deck of a yacht, amid the talk and laughter of a large party and the noises of the rigging, but when below, roused at any noise. There seemed also to be after-effect on her sleep from fresh air: after returning from a drive or being outdoors a long time, she would sleep more readily and soundly. On the 141st day she fretted and cried unusually over going to sleep, without any cause that I could conjecture except that she had missed her daily outing.

Difficulty in breathing, from a cold, waked her over and over (three or four days in the last week of the eighth month) even when she was tired and sleepy.

I find but the slightest indication of disturbance of sleep from digestive conditions, or general derangements connected with teething, — once in the sixth month, two or three fretful days, with unusual difficulty in going to sleep, while she had a cold, and two teeth nearly through; in the tenth month, several nights of broken sleep, with bad appetite in the daytime, which may have been due to teething, or to diet; and a short period in the eighteenth month (p. 233, above) when disturbance of sleep seemed due to a habit of eating between meals, and ceased as soon as the practice was stopped. For sleepiness after nausea, see p. 235, above.

I gave a good deal of attention to the after-effect upon sleep of the activities of the day. I never could see that muscular activity, however considerable, produced any effect on sleep. Neither did mental exertion, if unaccompanied by excitement. A day of the most eager and interested investigation of objects, *e. g.*, so long as it was quite self-inspired, never seemed to leave any sort of nervous disturbance behind, nor to have to be made up for by increased sleep. The effect of social excitement, or *rapidly changing* mental occupation (more rapidly than the natural limits of her attention called for) was quite different, and very noticeable. Here appeared

the effects of nervous over-activity referred to above (p. 253). The first instance was at the beginning of the second month, when callers came in to congratulate the mother and see the baby. On the first three days of the month (32d — 34th days) she saw a number of people, and as she now noticed faces and voices her attention was a good deal taxed. She seemed restless afterward and slept less than usual, waking more easily.

At about four months old she had several exciting days, all marked by happy interest during the excitement, but broken rest afterward. On the 121st day, her mother's sister was married from the house, and what with the arrival and dressing of bride and maids, the trip to church, where the baby was seized and passed about among kinsfolk she had never seen, and the return of the bridal party for lunch, her habits were entirely upset. She took all this with placid cheerfulness, although she had lost her morning nap and had been subjected to an extra dressing; and after the company was gone and the house quiet, and we looked for fatigue, she showed only a sort of pleased excitement, and perhaps a heightened receptivity to sense impressions (see *Music*, p. 115, incident of the 121st day); but she could not be got into a sleep that would last more than a few minutes, all the afternoon and evening; and during the night she waked repeatedly, always happy and wanting to play. The 130th day the baby was with her mother while she made and received several calls; and afterward showed again a pleasant excitement, — alert through her whole body, wanting to jump, and dance, and "feel her feet." She was coaxed to sleep with difficulty, and waked more than usual in the night. The 136th day a reception was given to the bridal couple: while the house was made ready, the baby was perfectly content to be neglected, as long as she could look on at the bustle; and while the rooms were occupied with company, she was happy and interested, with a smile for almost every one who spoke to her. Her mother took her away upstairs and put her to sleep, but she waked in five minutes, eager to go on with the fun, and would not sleep again. This time she became a little fretful by evening, but I have no record of restlessness at night.

So again in the eighth and thirteenth months (220th, 221st, 388th days) I find instances of happy excitement during the day,

followed by restlessness, broken sleep, and unusual trouble and timidity on waking. In the tenth month her father used to take her in his arms and run about with her in the garden, calling her attention to many things. This caused excited joy, followed by fits of unusual peevishness, with tears and clamorous desire for new excitement; I have not noted, however, the effect upon sleep. As a rule, after the middle of the second year, trips were taken and a great deal of sight-seeing for so young a child experienced, without noticeable excitement, or after-effect of restlessness; but there were exceptions to this. Even in the first year there were times when an exciting day seemed to have no after-effect on sleep; and it was noticeable that excitement from discomfort and distress passed away more readily, without affecting sleep, than excitement from amusement. There were times, on the other hand, when after the most unexciting days the baby fretted and would not sleep, or wished to play instead of sleeping, and would wake laughing in a few minutes after she had been coaxed to sleep.

In a single case (ninth month, 266th day) sleep may have been disturbed by nervousness following on agitation from pain and discomfort: the baby had fallen and skinned her lip, and afterward fell again on her face; had cried in vain to be taken outdoors (her one great comfort for all ills, refused her this time on account of the extreme heat of the weather); had been at last consoled by permission to pull books off some low shelves, and then had been interrupted suddenly in this charming occupation and carried off to be put to sleep. This succession of grievances put sleep to flight: she cried and resisted for an hour, whenever her mother tried to lay her down, and got only such sleep as she could, dozing in her mother's arms. It is likely that the effect on sleep in this case was due less to the previous excitement from the fall, than to the abrupt disturbance of a pleasant occupation: as early as the fifth month I note interruption of occupation as a cause of difficulty in getting the baby to sleep; and from the ninth month on to the middle of the second year instances occur over and over showing that when she was interested in something and was taken suddenly from it to be put to sleep, the disappointment, and probably also some nervous shock in the sudden wrench of attention (such as we ourselves experience in interruptions, sometimes with a feeling of

almost physical distress) made it very hard to quiet her and get her to sleep. See also pp. 274, 275, below.

In the second six months the fretfulness coming from lack of sleep seemed of itself, sometimes, to prevent sleep. I have notes of unusual sleepiness after a nap had been missed: but on the other hand, in the last week of the ninth month (239th day), when the baby had lost her afternoon nap on account of a cold, she was got to sleep with much lulling at bedtime, waked in fifteen minutes, and cried for an hour at intervals, while her mother tried to lull her; the cry grew very nervous toward the end, and the baby shed tears till her eyes were red. I thought her too fretted to get to sleep; and after her father came home and played a while with her, thus relaxing the nervous tension, she dropped easily to sleep. Her mother thought that as a rule in this month she went to sleep more easily if she was taken *before* she grew fretful with sleepiness. When a nap had been broken, and the baby had become fretful over the loss of sleep, it was harder to lull her again than if she had not been so sleepy; and sometimes she would not sleep again, though visibly sleepy the rest of the day. I note one instance, however, (361st day,) in which she was fretful with sleep, crying easily, and was very willing to go to sleep, gladly assenting to the suggestion of "bylow."

Though, as I have said, mental activity without excitement had no after-effect on sleep, interest easily dispelled sleepiness for the time being. This first appeared in the second month, 47th day, when the baby had been waked from a nap, and was fretting persistently with sleepiness; as her mother could not take her at once to put to sleep, I carried her to the piano and began striking chords to divert her; she became silent and absorbed immediately, and did not renew her crying till her mother came and took her away. In the fifth month (133d day) she had rubbed her eyes and seemed sleepy in my arms, so I gave her to her mother to be put to sleep; but she was no sooner settled than she began turning her head to look at me, and would not settle to sleep till I was out of sight, and she had looked for me for some minutes. The 136th day, when undressed while fretting with sleepiness, she stopped fretting at sight of her toes, and reached for them. Up to the end of the fifth month I could read in a low voice to the mother while

she nursed the baby and lulled her to sleep; but after that gave it up, as my presence and voice were apt to interest her too much (see Hearing, p. 111). Late in the sixth month, when she was fretful with sleepiness, and for some reason was not to be put at once to sleep, I took her into the kitchen, where she became deeply and happily absorbed in watching the dish-washing; but when she was taken away she cried hard, showing that she was still sleepy, but had been potently interested. The 171st day she would not sleep on a train, but sat staring with wide eyes. At a year old, she would not go to sleep, though very sleepy, in a large empty room, where the voice that was lulling her echoed from the walls in a way that interested her deeply. In the twentieth month, though she had been twice interrupted in a nap, she would not go to sleep on a ferry-boat, but insisted on trotting round and round, exploring with great interest. In the second and third years, when I sometimes put her to sleep (as related below) with stories, I had to take care to make them uninteresting, — long, droning narrations.

It is worth notice that in babies the sensation of sleepiness seems so often to be a highly uncomfortable and irritating one, instead of a mere languor, as with us.¹ After the middle of the second month, instead of simply becoming quiet and drowsy, the baby would often show want of sleep by fretfulness. (I noticed on the 47th day that just as in the case of hunger the pleasant

¹ The question has been raised whether it is in fact sleepiness, or the prevention of sleep after sleepiness has arrived, that causes the irritation. We ourselves find the feeling of *resisted* sleep (as in trying to keep awake during a dull address) most unpleasant; but the discomfort is not of the nature of irritability. On the other hand, when we have lost sleep, yet fail to experience a normal sleepiness, we are apt to feel instead a marked irritability. It is probable that with both infant and adult the fretful condition is not properly sleepiness at all, but a form of fatigue, which appears much more frequently in infants than in adults, unless the latter suffer from insomnia. This may be largely because the habit of regular hours of sleep, at which the drowsy feeling will normally appear, is not yet established for the infant. It is usually in the first year that the fretful "sleepiness" is most apparent; and in my niece's case the second year showed a time habit in sleep already of some importance: at the beginning of the 17th month, an attempt to put her to sleep before the usual time apparently made her very wakeful, and the last night of the 21st month, though she seemed so tired and sleepy that she was put to bed two hours before her usual time, she did not go to sleep for an hour and a half.

mood never passed gradually into this fretful sleepiness, but always suddenly.) I have notes in every month of the first year, after the first, of fretting with sleepiness. Sensibility to disagreeables was heightened: in the fourth month, to be undressed while sleepy was a great grievance, sometimes causing wails and tears, though oftener merely whimpering; I note instances of the same behavior in the sixth month, and throughout the second and third years she was far more ready to cry if anything was taken from her, or if she was interrupted in any pleasure, or denied some whim, when she was somewhat sleepy. In the open air, when wheeled or driven about, sleep almost always came on without any such fretfulness. The power of attention, memory, etc., was lowered: at fifteen months, *e. g.*, she became troubled when pressed to give a word while sleepy, though she knew it well and was usually very willing to give it.

Rubbing eyes as a sign of sleepiness is first noted in the fifth month, 133d day: it was already a habit.

It seems somewhat anomalous that a condition so natural and necessary as sleep should have to be artificially induced in the infant; and I find that some standard medical authorities on the care of infants say unhesitatingly that no baby need be lulled to sleep, but that a darkened room, quiet, and comfortable position, at the proper time, will always bring sleep, if no other influences have ever been used. Other standard authorities admit, if a little reluctantly, the necessity of lulling in many cases. Soothing the baby to sleep with songs and movements seems to have been the custom of mothers of all times and races, and it is hardly likely that a practice so arduous would have been so uniformly maintained had it been found superfluous. Even monkey mothers lull their babies in their arms, the cat licks her kittens to sleep, and the hen croons to the chicks under her wings. It is usually necessary for grown people to compose themselves to sleep for some time by deliberate effort, — an effort that must necessarily be made in behalf of a young infant by some one else. There are certainly normal differences between children in the ease with which they fall asleep. Many children will drop asleep amid their toys as they play about the floor, in their high-chairs at table, with food in their

hands, or as they sit resting in some one's lap, listening to stories, etc. My niece was never but three times in her life thus overtaken by sleep: and at seven years old, when many active and healthy children fall asleep "the minute their heads touch the pillow," as the saying is, she lies for some time, often half an hour, striving to sleep, and composing herself with all the songs and poems in her repertoire.

It is frequently urged that even if the baby will not go to sleep peacefully when laid down by himself, he will cry himself to sleep if left alone, and in time will learn to fall asleep without crying. The wisdom of leaving a baby to cry himself to sleep is not a medical question, but a psychological one, and I cannot see that here the opinion of doctors has the value of that of competent mothers. Some careful mothers and nurses report most favorably of the practice. Others oppose it strongly, saying that a child left to cry himself to sleep may, instead of bringing about a gentle fatigue, grow more and more excited, and cry with hysterical violence that might in some cases cause rupture, and certainly drives away sleep; that when sleep does come after such distress and excitement it is less restful than when the child was soothed as tranquilly as possible; and that the general effect on the nervous system is bad. Old-fashioned mothers say, also, that the approach of sleep is accompanied by exceptional conditions of susceptibility, which the mother should not fail to take advantage of for the emotional development of the child; that it is in the mother's lullaby and the association of her soothing and protecting presence, from the earliest dawn of consciousness, with this time of oncoming sleep, that some of the deepest roots are struck of the emotional relation between mother and child, which give it the almost mystical character it assumes in memory in after life; that as the child grows older, the bedtime hour is pre-eminently the time she should hold sacred to him, in which she will find his heart most open to all tender influence, and his confidence most completely hers; that the time and strength demanded by this ministry should no more be grudged by the devoted mother than she should grudge nursing her baby. Probably it is a matter in which extremes are to be avoided: every one has seen cases in which babies have become spoiled and tyrannical about going to sleep, and cases in which

mothers have inflicted much distress on themselves and the baby in compelling the little lonely, excited creature to cry itself to sleep for the sake of good discipline. Practically, too, the question of putting children to bed is apt to be complicated by rivalry between their claims and the husband's for the wife's society in the evening.

As to the farther question of *methods* of lulling, there has been general medical objection to the cradle. It is said that the sleep induced by motion is not natural sleep, but of a hypnotic nature. Ploss (*Das Kleine Kind*, pp. 65-70) sums up the opinion of different German authorities, and concludes that the real objection is not to gentle rocking into sleep, — which is, he says, essentially nature's method, as the infant is carried about on the mother's back, or lulled in her arms by a gentle swaying of her body, — but to rough and jolting motions, and to continuing the rocking after the child is asleep, as the cradle tempts one to do. I have pointed out above that the young child is certainly less susceptible to disagreeable sensations from jarring or from dizziness than the adult, and it is possible that the solicitude as to the effects of rocking infers too much from adult conditions. Even in the case of adults, there is no evidence that sailors suffer any harm from sleeping amid the motions of the ship, and people go yachting expressly for the sake of the refreshing sleep which they claim the motion brings them. Birds, whose development of the ear-canals must make them especially sensitive to motion, sleep amid a swaying of branches that sometimes becomes quite violent without disturbing them. Our knowledge of the reasons why motion induces sleep seems to me still too limited to justify dogmatism on the subject.

In the case of my niece, the nurse and grandmother being at one in advice, the mother decided to make no attempt to teach her to go to sleep alone. During the first two months, she usually dropped to sleep at the breast; at other times the nurse easily lulled her by patting. No one else seemed very successful with this method, but in the second month the motion of the baby-carriage usually brought sleep. As I have said above (p. 119) the rougher motion proved the more soothing, and even if the baby had been fretting as the carriage crossed the smooth veranda, her complaints would stop as soon as the wheels touched the gravel walk, and she would lie placidly till her lids dropped in sleep. At

this time too, (latter part of the second month,) when she now and then had to be coaxed to sleep without the carriage, the most efficient way proved to be to lay her along my knees, her feet against my body, her head resting in my palm, and to trot her with a short, joggling motion, crooning monotonously; this process would send her to sleep even when she was crying quite hard.¹ She went to sleep in driving more easily than when wheeled in the baby-carriage.

In the third month, she was fond of being held up against her mother's right shoulder, so that she could get her left thumb into her mouth, and would then lie contentedly and go to sleep. Sucking the thumb, however, was not very firmly associated with sleep, for she sucked it also when wide-awake. About the middle of this month she was given a small, closed rubber nipple, which she soon began to suck instead; and within a week this became firmly associated with sleep. With this third month, also, the mother, wishing to limit the sleep association to herself, took exclusive charge of putting the baby to sleep (rocking in a chair and singing softly, the old-fashioned way); and by the 83d day evidence appeared that the association was somewhat established, when the baby, who was fretting in her grandmother's arms, nestled down contentedly and went to sleep in her mother's. (It is to be remembered that she did not know her mother by sight at this time, and had no preference for her, except as she recognized her touch and manner of holding in connection with sleep and feeding; indeed, as a rule, she had preferred her grandmother's arms.) The 89th day, her mother was occupied for the afternoon, and wished to delegate the putting to sleep for once: but after being entirely happy in my charge for an hour or two, when the baby grew sleepy she cried for her mother, and would not let me put her to sleep, nor be consoled till her mother took her.

In the fifth month, the rocking and soft singing failed, and the

¹ It is said by experienced nurses that babies who refuse to go to sleep when rocked smoothly, are sometimes readily soothed by jolting. I have been told of one baby who had all the evening resisted efforts to put her to sleep, till in despair her grandmother took her, and sitting down in a kitchen chair began to tilt it back and forth, from front legs to back; and this racking motion promptly sent the baby to sleep. Another baby would not go to sleep in a cradle till a stick of wood was put under the rockers, so that the cradle jolted heavily at every swing.

regular process of putting to sleep was to seat the baby upright on her mother's knee, give her the little rubber nipple to suck, and then joggle her roughly and monotonously up and down, singing, "John Brown had a little Injun," until she grew drowsy; then to cuddle her up in arms and go on with the singing very softly. Once in this month I find a note that she would not sleep, and fretted, and finally cried in earnest, until her mother rose and walked with her, when she became quiet, and in less than a minute dropped asleep; but walking with her was unusual (see also the incident below, p. 282).

In the sixth month it became evident that the use of the rubber nipple to suggest sleep had become tyrannous. It had been left at a house where she was visiting, and she cried hard at having to go to sleep without it, and fumbled with her mouth and tongue for it all over her mother's face and shoulder. A week later she was accidentally waked in the midst of a nap, and the nipple was discovered to be elsewhere: she could not be got to sleep again without it till two or three hours later, when, being very sleepy, she was at last coaxed to sleep with a wooden handle shaped like the nipple. The nipple was not restored till afternoon of the next day, and every time that she went to sleep in the interval was after hard crying for five or ten minutes, or even half an hour. The mother now determined to withhold it and break her of its use. The baby got through one night fairly well, and went to sleep at the breast for her morning nap, but lost her afternoon nap entirely; the next night she was awake crying two hours, and finally her mother surrendered and let her have the nipple. The comfort she experienced in its use must have been quite positive, causing peculiarly pleasant associations, for twice in the latter half of this month, when the nipple was held up before her, she greeted it with a cry of delight, and demonstrations with hands and feet, — as I have seen babies greet the sight of their nursing-bottles. This raises the question whether the association of pleasure with the nursing-bottle is so entirely due to its connection with food as has been supposed.

With the growth in importance of the nipple as a sleep-suggester the trotting ceased, and the gentle rocking and singing, with its help, was again sufficient. If the baby waked at night, to

give her the nipple and sing a little was enough, without taking her up. In the twelfth month, 347th day, the mother tried again to break her of the use of the nipple: she cried hard and distressingly, growing very nervous, and uttering short sharp wails, as in pain, for about an hour, and her mother again surrendered; and (with the exceptions mentioned below) the use of the nipple remained imperative up to the end of the sixteenth month. At this time a bad cold made the child breathe through her mouth, so that she could not use the nipple; this cost her her day nap for some days, but she was got to sleep at night without it, and presently returned to the day nap also without it, and so dropped its use altogether with little difficulty, after all.

Meanwhile, the nipple, singing, and rocking, had never been necessary when driving, though singing was a help even then; once in the eleventh month, 315th day, the baby went to sleep when driving after she had refused to sleep at home, even with the nipple and singing; in driving, also, she would go to sleep in any one's arms, but at home not unless her mother held her. In the ninth month a nap was now and then coaxed by giving the baby the juice of fruit to suck through a cloth, but the device soon failed. The 266th day she entirely refused to be put to sleep by her grandmother in her mother's absence: when given a loquat to suck, as soon as she perceived she was being put to sleep, she cried and did not care for the loquat. I took her and walked with her; she sat quietly in my arms, leaning on my breast, but would not lay her head down; and when she found I was not going to take her outdoors, she began a low complaining murmur. I took her at last to the veranda, and walked up and down within the shade. She looked very happy till she perceived that I did not mean to go outside that small beat (on account of the extreme heat in the sun); then she began to look longingly at her baby-carriage each time we passed it as it stood on the veranda, turning her head to look back at it, till at last I put her into it. She broke into a bright smile, and was happy as long as I wheeled her about outdoors, though she was very tired and sleepy. She would not go to sleep, however, till she was taken driving, and even then resisted somewhat.

With the latter part of the eleventh month the need of her

mother's arms as a condition of sleep became somewhat less imperative: on the 324th day she held her arms to come to me, and laid her head down on my shoulder as if to go to sleep; her mother took her away to bathe her, but afterward laid her back in my arms to see if she would really go to sleep there; she gave one little cry of protest, then laid her head down and went to sleep in my arms. Once this week when very sleepy she went to sleep when walked with by her father. In the following months, as long as the daily nap was kept up, she repeatedly allowed me to put her to sleep instead of her mother, but on the whole the association of sleep with her mother was pretty firm, and it was once or twice necessary for me to walk with her. It is to be observed that as neither the grandmother nor I could sing, and had to substitute a mere crooning, or tuneless chant, the absence of her mother meant also the loss of the accustomed lullaby.

In the eighth month the grandmother said that while driving with her, the baby sang herself to sleep with a sort of crooning; in the ninth month when I began to croon "bylow" to her while driving, she took it up herself with a crooning sound, and at once dropped off to sleep. Just at the end of the year she took up a habit of beginning a little drawling sound when sleepy (â-â-â), which she liked to have some one return, then would drop it to a softer and languider note, till in effect she had sung herself to sleep. We found that when she began the notes, if they could be followed up at once by comfortable position, quiet, and an answering crooning, — sometimes a little swaying to and fro in the arms, — she would usually go to sleep. This did not become a fixed habit, but for a time in the thirteenth month it interrupted the use of the nipple, which of course she could not suck while crooning.

Some weeks before the use of the nipple ceased, the child had acquired a new habit connected with going to sleep: lying on her mother's arm, with her head on the shoulder and one arm about the neck, she would put up her hand and feel for the hairpins in her mother's thick coil of hair, to pull them out; how early this began I did not notice, but by the last week of the fifteenth month she could not go to sleep, either in my arms or her mother's, unless she was pulling out the pins, and even after her lids had fallen the little hand would still fumble in the hair. I failed also to note the pass-

ing away of the habit: it must have lasted a month or two, and doubtless aided in the emancipation from the nipple. After this, the mother put her to sleep with rocking and singing only, and I sometimes (after the eighteenth month) with long monotonous narrations, rhymes, counting, etc., in a low even voice. These methods lasted in the case of the day nap until it was given up in the twenty-seventh month: in the latter months of the period, however, they sometimes failed, and nothing but a drive would bring the nap; sometimes even the drive failed.

In the last week of the eighteenth month, (seventy-seventh week,) the child took up, quite of her own accord, the idea of going to sleep at night by herself in her crib. I cannot find that before the twentieth month she actually went to sleep thus more than once or twice: she would lie quite still for fifteen minutes or so, then call, "Mamma ta' Wu'!" and would be taken up and rocked to sleep; or else she would throw the covers off, and as she had a cold at the time, her mother would take her back to her lap, where she could keep her well wrapped. She objected much to this, and once in the eighty-second week I heard her crying and begging for "own bed!" At the beginning of the twentieth month, she was allowed to stay in it, and now fell asleep there without difficulty, and her joy in it was great; she seemed to have a real feeling of attachment for the little bed. Once when her mother went to turn her over and cover her after she was asleep, she roused slightly and murmured, "In bed!" afraid she would be taken out. In the eighty-fourth week her mother took her back to her lap for a night or two, because she insisted in poking a foot out to feel the floor-matting with her toes; and she cried loud and long, begging, "In bed!" Nevertheless, in the last week of the month, she began to resist going to bed, and in fact going to sleep anywhere, and had to be rocked and sung to sleep again for a fortnight. After this, she was willing and even desirous to go to sleep in her bed; but only on condition that her mother would stay beside her and sing. Her mother wished her to go to sleep alone, and I often heard her crying for an hour over this before she went to sleep. Once (ninetieth week) she cried so long and hard that her mother took her up and rocked her to sleep, and after that consented to stay beside her. For about a week the child was somewhat uneasy and solicitous, and when bed was pro-

posed would ask, "Mamma lie down on mamma bed?" and when assured that her mother would lie beside her and sing, would go happily to bed; in her crib, she would nestle about, talk, ask for a drink, hold her mother's hand, and finally drop to sleep. By the first night of the twenty-second month she was reassured, and would ask when undressed to be put in "our dear little bed."

In the last quarter-year her mother tried gradually to accustom her to being left to go to sleep by herself, and by the twenty-fourth month I find her submitting to it without actual protest, but with devices to detain her mother at her side, such as offering to tell her a story. Instances of this occurred throughout the third year, and indeed are not unknown at seven years old. The mother always sat in an adjoining room, lighted, and separated only by a *portière*, and there was usually talking and reading going on, so that the child was well aware of her neighborhood.

The last night of the second year the association of being put to bed by her mother and having her at least close by, was for the first time broken, and with unexpected ease. The mother was obliged to go to a sister who was ill: the matter was explained to the child, and she was asked if she would let aunty put her to bed, that mamma might go and take care of poor Aunt May. She said, "Ye'" easily, kissed her mother goodnight with entire cheerfulness, finished the peach she was eating, let me wash her hands and face, and asked in her politest way, "Aunty, may Ruth have cubes?" (Hailmann beads, see Sight, Form), played happily for twenty minutes, then consented readily to go to bed, kissed the family goodnight pleasantly, and let me undress her and put her to bed without a complaint. It is likely that she was sustained by a special pride of good behavior on this occasion; and also by the privilege of keeping me beside her till she went to sleep, in consideration of her mother's absence. She asked me to "lie down on big bed," and tell a story; I told a long, monotonous one, and she punctuated it with contented "yeses" till she dropped off to sleep. The next night she expressed some desire to have me put her to bed again; but the night after, when told her mother must go, began to cry; as soon as I came to her, however, she put her arms around my neck, kissed her mother goodnight cheerfully, and went to sleep without resistance under a long murmuring story, — again dropping in a sleepy "yes" whenever I struck a familiar image.

After this, throughout the third year, the mother was obliged to be away from home repeatedly for several days at a time, and the little one's crib was at such times placed in my room. I always stayed beside her till she slept, and thus had the opportunity to observe her habits in going to sleep. The first time (last week of the twenty-fifth month) she went off to bed with me gayly, laughing at the novelty of having her crib upstairs, got into an irrepressible gale on my bed, capering wildly, shouting, and laughing; after she was in her crib, she wished a story, and then consented to go to sleep while I lay near by. She had a doll in her arms, (from the sixteenth month she had now and then insisted on going to sleep with a favorite doll in her arms, and does still; but it never became a fixed habit, at all necessary to sleep,) and talked to it a few minutes, nestling about, then dropped suddenly asleep. Later she waked and cried (see below, p. 286-7) and was at last rocked to sleep. The next night she talked a while, asked for a story, lay silent a while trying to go to sleep, prattled a little to herself, then flung herself across the rail of her crib, and putting her arms around my neck as I lay close to the edge of my own bed, lay dozing, her head on the rail of her crib, pressed against my face; and even in her sleep she would cling closer if I moved, and twice, rousing a little, kissed my face and hair; it was some minutes, and she was fairly asleep, before she rolled off to a more comfortable position. The next night she wanted a book to "read" in the dark (as she had done waking in half-light that morning), prattled a little from it and wished me to do so, listened to a few Mother Goose rhymes, then, told she must lie still and go to sleep, prattled to herself and wriggled about a long time first. So during several more nights that she slept beside me, and on other occasions through the year when she was with me for a few nights, she accepted me easily in place of her mother, helped by the fact that I placed her crib more closely against my bed, and lay beside her till she slept, so that she could reach over and cling to me, or during the night could sometimes creep over into my bed. In the 27th month, her crib was set as close beside her mother's, so that she could crawl over and cling to her in the night, as she had been doing with me. The next time that she slept beside me, she whimpered for her mother a little, but as long as I talked to her was content; when I stopped,

she would begin to call for her mother, so I had to talk her to sleep. Two months later, however, she was perfectly content to go to sleep beside me, rolled over and put her hands about my neck, and asked questions about owls, bees, etc., listening drowsily to the chat about them, which I made low and monotonous, till she dropped asleep. It was my theory that this quiet talk tranquilized her better for sleep than to be left in entire silence.

Once in the 27th month, when her mother was going out in the evening, the child went cheerfully to bed with me, but when her mother came in with wraps on to kiss her goodnight, began to cry for her. In the thirty-second month, a young girl came to the house to take partial care of her in the daytime for a few weeks; and the very first night she was in the house, only about an hour after her arrival, the child, who had so far made no acquaintance with her, dismissed her mother as soon as she was put in bed, saying, "You may go away; Clara will stay with me," and was more than satisfied to have the stranger beside her till she slept. In the thirty-third month, returning from a camping trip of two weeks, for several nights she wished me instead of her mother to put her to bed.

There seemed to be in my niece's case not merely difficulty in getting to sleep, but for months at a time an absolute repugnance and resistance to sleep. This seemed at first due to a desire to play instead of keeping still. It did not appear till toward the middle of the fifth month: one day in this month (134th day) her father came home at evening while her mother was putting her to sleep, and interrupted the proceeding in order to play with her for a long time. The next evening at the same hour her mother took her to put to sleep; but the baby kept breaking into the lullaby with a troubled little cry, and finally an incipient wail. We could not find any possible reason, and concluded it was a coming tooth that pained her; her mother gave her a finger to bite, cuddled and pitied her, and at last, for want of anything else to do, as the fretting cries continued, lifted the baby against her face, letting her bite and mumble at cheek and chin. At this the baby turned and smiled broadly at me, and we perceived that she had simply been fretting for a frolic. Her mother put her on her foot and swung her up

and down, and she was joyously content, and after a little play grew drowsy and went readily to sleep. No doubt, had her mother tried to force her to go to sleep, she would have resisted more and more, become excited and sleepless, and lost more sleep than by the concession:¹ but on the other hand, had the going to sleep not been interrupted the night before, she would have slept this evening without resistance. The next day occurred the reception spoken of above, when her pleasure and excitement kept her from sleep; and the next evening she cried over being put to sleep because she was disappointed at having to leave a plaything. After this I find recurring notes of resistance to sleep, and desire to play instead. In the latter half of the fifth month it was very common for her to wish to stay in the family room and play, and to whimper when taken away to bed; she was usually wide awake and full of gayety at just this time. The 225th day it was noticed that she babbled more freely toward bedtime. This same night her mother brought her into the family room to say goodnight before putting her to sleep, and she fairly squealed and sprang to be taken by her grandfather (who was her best playmate), and was very unwilling to go back to her mother, as if suspecting she would then be put to sleep. This reluctance to go to her mother at bedtime had been growing evident since the beginning of the eighth month or earlier, and it now became quite marked. The 229th and 230th days,

¹ It is likely that too much inflexibility in trying to *force* a wide-awake, playful baby to sleep ends in nervous excitement that not only puts sleep still farther off for the time, but establishes most unpleasant associations with the process of being put to sleep, which will affect it for some time. It is doubtless good counsel that care should be taken not to get the baby wide-awake and full of play as bedtime approaches; but it seems to me also good counsel (as given by the grandmother) that when the baby is already in this mood, it is better to let her get a little of the play out of her before trying to make her sleep. See also an incident of the 239th day (p. 260, above) concerning the effect of a little play in restoring nervous equilibrium and making sleep possible. So too in the second year, when the child was just seventeen months old, she showed an unusual fretfulness at dinner when brought in from outdoors, cried to go out again, then to be allowed to hold her own cup and spoon, etc., in a manner most unlike her. After she was undressed, the evening being very warm, I rolled her in her little blanket and took her outdoors and let her see the moon, the toads hopping about the garden, and so on; she became quiet and happy, and was soon quite content to come in and to go to sleep.

when her mother tried to take her from me after she was in her nightgown, she whirled about and clung tightly and persistently to me. The 231st day, after she was ready for bed, she was put down on a table, where she rolled and played about till her mother came to get her, at which she whirled away, clutched at the table, and buried her face to cling there, as she had done in my arms; when taken, however, she went perfectly pleasantly. The 240th day, although she had had no morning nap, she would not go to sleep when wheeled out in the baby-carriage in the afternoon, but sat bolt upright with lids drooping, striving to keep awake, — I thought because of desire to enjoy the outing. An instance of her resistance to sleep on the 266th day has been given above.

At the end of the tenth month came a change. The 302d day, waked in a nap, she clung to her mother, hiding her face on her shoulder, and showing desire to sleep again, though she could not; and again a half-hour later, when undressed to be put to bed, she clung to her mother, hiding her face and feeling for the rubber nipple, desiring to be lulled, instead of resisting. During the next week she cried hard, as before, over being put to sleep, and on the 303d day, when her father took her as she was playing with me, though she reached her hands willingly to go to him, she cried out as soon as he turned to the bedroom door and reached her arms back to me, and as the door shut behind her broke out crying bitterly. But on the 309th day, when her mother put the nipple in her mouth as a preliminary to carrying her off for her afternoon nap, she laid her head down at once on her mother's shoulder, and slept readily; and during the rest of the eleventh month, and still more in the twelfth month, it was the rule (not without exceptions) that she went readily and cheerfully to sleep, if tact was used in not breaking too suddenly into an employment, and in taking her when she was sleepy, but not sleepy enough to have become fretted. The 324th day, as noted above, she composed herself voluntarily to go to sleep in my arms; the 325th day her mother told me that she *asked* to go for her nap, uttering begging sounds till her mother took her in arms, saying, "Shall mamma put Ruth bylow?" to which the child answered with a sound of satisfaction, and settled down gladly to sleep. In the twelfth month I often heard her gladly assent to the suggestion; in the fifty-first week when asked,

"Shall we get the 'stopper' [nipple, which was set in a stopper-like ivory disk] and go bylow?" she would nod, and put out her hands and take the nipple, put it in her mouth, and nestle down in her mother's arms in the usual position to go to sleep.

In the last week of the year she began to resist the second daily nap, keeping resolutely awake all the afternoon, though very sleepy, and crying if any one tried to put her to sleep; and this resistance was kept up till the afternoon nap was given up: but I have no other note of resistance to sleep till late in the fourteenth month, when I find mention of her "Na, na, na!" shaking or nodding her head vigorously, in protest against bed; in the sixty-first week I note that while she never showed anger, there was a certain resentment at being taken away to sleep, and she would refuse to kiss goodnight, — perhaps with a crude idea that by doing so she made it sure that she would be taken. I have notes up to the latter part of the twentieth month of this reluctance to bid goodnight when taken to bed against her protest. At such times, however, she soon developed a considerable desire to come out again and kiss the family all round *after* being taken to bed. In the fifteenth month I note a disposition to cling very close to me as bedtime approached. On the whole, however, she went cheerfully to bed through the whole of this half year, though usually not without a certain amount of protest; and if she was suddenly taken away from an interesting occupation (as turning over a favorite basketful of buttons) there was sometimes bitter crying.

At eighteen months old, as mentioned above (p. 199), she once asked for "bed" after a hard play; but a week later was exceedingly unwilling to be put to sleep, and cried hard over it; and when her mother proposed to tell her a story, she began to cry and protest at once, knowing that it was intended to inveigle her into sleeping. After this, throughout the third quarter of the year, she became again very averse to going to bed; some vigorous protests against the nap, too, or absolute refusal of it, are noted. In the eighty-first and eighty-second weeks, when her mother came to take her to bed, she would cling to me, sometimes stiffening her back with a little temper and crying out in intense protest. "Aunty come back!" she would call after me in the twentieth month when I left her in her mother's lap; "Aunty take Ruth more!" when her mother

came to take her, — clinging and cuddling to me, her face pressed against mine. In the twentieth and twenty-first months it was not uncommon for her to cry bitterly, sometimes for an hour, over being put to sleep. Once in the ninetieth week, brought indoors to be put to bed, she was no sooner set down on the floor than she made a dash first for one door and then for the other. When caught, however, she gave up and went to bed graciously enough. In other cases, after some loud scolding and protesting, she would go quite cheerfully to bed. One evening in the eighty-eighth week, she whimpered to go to her mother from her father after she was undressed, and after consenting to kiss me goodnight dismissed me peremptorily with, "Go 'way!" and as I lingered outside the door to see her settle herself for sleep, added sternly, "Shut door!"

The recurrence of aversion to going to bed in this quarter-year was very likely connected with the transition from going to sleep in her mother's lap to going to sleep in the crib. When the question of method was settled to her liking, the aversion seems to have disappeared; at least, I find no note of it afterward.

In the third year, I find scarcely a hint of resistance to going to bed; nothing more than that she now and then went "reluctantly;" and once in the twenty-ninth month, when her father came to take her to bed, she tried to put him off with, "I busy." My record in the third year, taxed by the increasing complexity of psychical development, is far from full. In these matters, and such an incident is doubtless but one of many: but I have notes enough that show a general habit of cheerful readiness to go to bed. In the twenty-fifth month, *e. g.*, "Her mother calling her to come to bed, she rose obediently, kissed us all, and trotted off, tugging chair and doll." In the first week of the twenty-seventh month, immediately after supper, she announced that she wished to "go straight to bed," — probably because she was to sleep upstairs with me, a novelty; it was an hour before her time, but she stuck to it, and went happily to bed. A week later she seemed sleepy at dinner and I asked if she would like to go to bed. "Yes. And have my clothes off, — so," showing in a pantomime. She was firm in the purpose, and was undressed and went. In the second week of the thirty-second month I note that she habitually asks to be undressed and put to bed about 8 o'clock. (Her bedtime had

always been later than that of most babies on account of her father's late return by train.)

To some extent in the second year, and still more in the third, she was disposed to caper and play when undressed, and had to be kept under some repression even after she was in her crib. In the early part of the twenty-seventh month she regarded it as a joke to keep putting out a foot or hand from the warm crib into the December air. Later the same month, I went in one evening after she had been left in bed, and found her jumping round on her mother's bed in great spirits. "Did mamma say you might?" I asked. "No," said the child composedly: "she sai', 'Tay i' you li' be'" ("she said, Stay in your little bed"). Her mother coming in at the moment ordered her back into bed, and after lingering as long as she dared, she obeyed; then, "Mamma, I want a drink!" As soon as her mother was gone for water, she climbed out and began capering round again. "Ruth!" said her mother sternly, returning. "Here!" called the child with a dramatically innocent tone. She scrambled back to bed at the last moment she dared, and then proposed to "give aunty part of my drink," as a pretext for another excursion.

Reluctance to go to bed even in the first year, and still more in the second, could often be allayed by certain ceremonies: thus in the latter part of the fourteenth month she "could be reconciled even to going to bed" by being set to waving "by-by" with a handkerchief, a highly valued accomplishment. At eighteen months old she attached great importance to my carrying her into the bedroom and laying her down in her mother's lap to be undressed, and would give up her occupations and go contentedly on this condition: the next week she wished me to take her after she was undressed and lay her in her mother's lap, — the more purely a ceremony, as she was then laid at once in her crib; it would not answer at all, however, for her mother to lift her in the first place and put her in her crib. Later in the month, though she would cry out in protest at being taken from me to put to bed, she would become quite content if I would agree to go with her and sit by while she was undressed; next (twentieth month) she wished me nightly to come in and lay her in her crib. Once (twenty-first month) being arrested on the stairs while bringing down a little

bucket with shells in it, she resisted strongly, crying, "Want go upstairs!" and protesting against the idea of bed; but when she found protest vain, she asked that she might take the bucket of shells with her, and when this was granted, became somewhat reconciled. In the twenty-seventh month, though carried off to bed while her interest in the striking of an old clock that she had been allowed to experiment with was still intense, she made no resistance, the suggestion, "Say, 'Goodnight, little clock,'" being enough to reconcile her to parting, as a similar one usually did at the time.

The increase of disposition to affection and confidence at bedtime was very perceptible to me in the third year, as it had been earlier to her mother. Her willingness in the latter months of the first year to nestle in her mother's arms, or even mine, to be put to sleep, had showed the rudiment of this, since she was ordinarily an independent child, not disposed to be held or caressed. It was clearly evident in her desire to keep her mother by her, to hold her hand and feel her companionship, in the latter half of the second year. Several times during this period, when her mother refused her hand on cold nights, the child begged to be allowed instead the end of her mother's long braid of hair, and went to sleep clinging to that. The desire of my attendance to lay her in her mother's lap, etc., had some element of the same increased sense of need for companionship: she was not especially loath to part with me at other times. Several instances have been given above of her clinging behavior when she slept with me in the third year, and many others might be given. Once, *e. g.*, at the end of the twenty-fifth month, when I blew out the light, lying on the bed beside her, she presently rolled over, felt for me and hugged me a few moments, then back to her nestling and prattling to herself, — not as if she felt fear in the dark, and wished to assure herself of my protection, but as if she experienced a wave of affection in the consciousness of my *companionship* in the darkness. So too during the night: in this same week, *e. g.*, finding her uncovered and chilled, I wished to take her into my bed; she refused, and cried and resisted when I tried to lift her in, so I waited till she had dropped asleep, then moved her; and when she was once there, rousing from time to time, she clung sleepily to me, felt with her arms to put them

around my neck, patted my hair and face, and once felt with her lips, half asleep, to kiss, murmuring my name, then dropping asleep again. Even as early as the eighteenth month I find instances of willingness to curl up in one's arms for a confidential chat at bedtime; and at twenty-five months I found her in an affectionate and acquiescent mood for a talk on misdoings of the day.

There was much that was quite striking in her behavior on awaking from sleep. The first note that I have on the subject records a condition of high general felicity after sleep: this was on the 32d day, when, having slept very late, and being comfortable otherwise, the baby was jollier than I had ever seen her, smiling over and over. After the long sleep (8 hours) of the 56th night, she was very active about holding up her head and insisting on being given a sitting position, — yet perhaps not more so than usual: after the long sleep of the 61st night (9¼ hours) she was in high good humor all the morning, and showed delight in some colored strips with which we had before failed to attract her attention. Throughout the whole record I have notes of contentment or jollity after a good sleep. On the other hand, there was sometimes noticeable fretfulness after a nap: I note it but once in the first five months (47th day); but from the beginning of the sixth month I find repeated notes of a fretful mood and disposition to cry, lasting sometimes a few minutes, sometimes for hours, after a nap. The reason for such difference of moods was not clear, but I have made some conjectures concerning it, as will be seen below.

That the baby should often whimper on waking was to be expected in the earliest months, as she was likely after the interval of sleep to be uncomfortable from hunger, thirst, or wetness. Yet after the 9¼-hour sleep, an extremely long interval, she did not cry, and showed hunger only by vigorous sucking of her fist. This made me suspect that the discomfort sometimes shown on waking might include a little remnant of sleepiness, even when she seemed to have waked quite spontaneously: the sleep had perhaps been broken in its light final stage by some imperceptible disturbance before the baby had quite had enough. I have a note on the 105th day that she was waked in the middle of a nap by being bundled off the cars, and took it with entire cheerfulness; but it was of course exceptional not to show discomfort from a broken nap.

On the same day (32d) that I noted in the morning her unusual display of smiles, she wept at noon her first tears, having waked alone and cried some time without being heard. There was no evidence as yet that this unusual distress was due to anything more than the continuance of the uncomfortable sensations that had caused the crying; but it did become evident soon that to wake and cry awhile alone, without bringing help, gave her a distress that had an element of terror. Being left alone in itself she did not always mind, — she lay contentedly alone in a room for a half hour while the family went to breakfast, on the 37th day; nor even waking alone in itself, — as when, on the 112th day, she waked before light in the morning (alone, so far as she could perceive, in the dark) and announced herself by a series of loud and joyous croaks. It was only after crying awhile alone and unnoticed that the note of panic appeared. In the last week of the fourth month, the 119th day, she waked alone in the dark, and had been crying some time before her mother heard her and brought her out to where we were at dinner, and put her into her high-chair, where she was usually very happy in the lights and sounds. She had evidently grown frightened while crying alone and was not yet fully reassured, and was quite unwilling to leave her mother's arms; she kept leaning toward her from the high-chair (she had not yet learned to hold out her arms) and uttering troubled cries; then as it was some minutes before her mother took her, she grew more and more disturbed, till she was crying in real fright again, and was soothed with difficulty. The next afternoon at about the same time, waking alone, she began at once to cry with the note of fright, and was hard to soothe. I did not think the dark had much to do with her fear, except as it helped to recall the impressions of the afternoon before. The 122d day, after there had been time for this association to fade, she waked, and even cried alone in the dark for a while before she was heard, without showing any of the fear of a few days before: but she was still in a condition of happy excitement from events of the day before, and as noted above (p. 258) both on this occasion and twice in the fifth month, though unable to sleep much, she always waked in joyous spirits while the effect of the excitement remained.

In the last week of the fifth month (147th day) she waked in

the evening and whimpered, and her mother being absent, her father took her up and attempted to soothe her. This was a new proceeding, and evidently excited a feeling of fear, and by the time her increasing cries had summoned grandmother and aunt, she was in a good deal of panic, crying tears, and was with some difficulty quieted and diverted until her mother's return, some twenty minutes later. Once in the sixth month, 164th day, she showed fear when I took her, in the dark, from her mother's arms just after she had waked; but when I had brought a light, she recognized me with a smile.

It was evident that so far there had been only occasional alarms on account of some special cause just after sleep; but in the latter part of the seventh month I noticed that she was habitually troubled and timid on first waking, clinging to her mother and ready to cry pitifully if taken from her. This I note over and over in the first half of the eighth month. In the tenth month she usually cried hard immediately on waking, though by the eleventh month a sort of troubled whimpering of "Mam-mam-mam" was commoner. It seemed strange that so happy a child should so rarely wake happy, and I felt satisfied that there was some confusion of mind in returning to consciousness that caused fear or distress, which was deepened by finding herself alone, as she commonly did on waking from a nap, and that it would be well if some one could always be in sight when she waked, — at least until associations of confidence and familiarity could replace the unpleasant ones that had gathered about the moment of waking. In the eleventh month, 325th day, I found an opportunity to step at once to her at the first stir of waking, and found her lifting her head from the pillow and saying, "Mam-mam," in a whimpering tone. When she saw me, as I stood quietly beside the crib, she laid her head down again for nearly a minute, as if she would sleep again; then began to nestle and complain, got up, holding to the edge of the crib, and clung to me, and presently held out her arms, and when I took her, she seemed at once happy and sunny. In the afternoon her mother took her up when she cried on waking from her nap, and carried her into the next room; she seemed sleepy and shy, but almost at once pointed to a picture that she knew, and then to me, with a curious effect of rediscovering her world, — coming back to

recognition of her surroundings, — and soon was bright and happy again. This behavior confirmed my impression that she passed through some stage of intimidating confusion on the borderland of sleep, — due doubtless to slow re-establishment of cerebral circulation, or to disturbances of general sensation, but just what sort of confusion would be hard to guess in the case of such a little thing, — and that she found a familiar face and protecting arms quite a rope to cling to while she made her way back to firm ground of waking consciousness.

In the latter part of the eleventh month, though she still cried when she waked alone, she seemed growing less timid than she had been. But the 332d day she waked alone in the dark, while her father was talking loudly in a neighboring room (perhaps was waked by the sound of his voice, and did not recognize it through the wall) and cried some time before she was heard. When she was taken up, she quieted a little, then began crying again, and cried harder and harder, quieting, then breaking out again, for nearly an hour: she never had cried so in her life except once for a colic, an unfamiliar ailment which seemed to cause her more terror than pain (see Pain, p. 154, footnote). The efforts of the concerned and sympathetic family to divert her probably added to her excitement; she clung to her mother, would have no one else and cried least when her mother walked about with her in a brightly lighted room, talking softly and cheerfully to her. At last, when she was quite tired out, her grandmother brought her a drink of water; she took it gratefully, and almost at once fell asleep. During the night she waked often, crying. For some days after this her crying on waking alone was invariable; but on the 338th day she slept three hours later than usual in the morning, and on waking made no cry, but tried to help herself to the cup of milk left standing beside her crib since the midnight meal, and only after spilling the remnant of this did she raise her voice. Her father came to her then, and she instantly reached her arms to him and pointed, begging to be taken outdoors. She was afterward unusually happy in the bath. This incident renewed my impression of the second month that if sleep could be absolutely finished out to the end, the state of confusion and uneasiness would not intervene between sleep and waking. The moral of this is that

it is well to guard the quiet of a baby's sleep and prolong it to the utmost, instead of trying to accustom him to sleep through noises. In the later years of childhood (see pp. 255-6, above) sleep is so much sounder than in infancy that if such training is necessary (and of course sleepers cannot expect to go through life in a cloistered seclusion from sounds) it can be begun then.

In the early months of the second year the habit of waking in distress rather increased than lessened. In the thirteenth month I note that the child always wakes crying most bitterly, as if in grief or pain. In the last week of the month (fifty-sixth week) she waked from a nap prematurely and was very willing to let me put her to sleep again: she did not go soundly enough to sleep, however, to be laid down, so I sat holding her till she waked. She opened her eyes and looked into my face with a startled expression at first; then she sat up and pointed to a picture of a dog on the wall, saying, "Wow-wow!" (again as if relocating herself by means of a familiar object.) She was willing at once to be put on the floor, went directly to her toys, and was much interested in them; there was no interval of crying and clinging, and I was disposed to attribute it to the fact that she had opened her eyes to a familiar face.

I had not hitherto attributed her distress in waking to any fear of the dark, though darkness doubtless heightened timidity from other causes. I now noticed, with the beginning of the fourteenth month, that when she waked and cried in the dark, she was not easily soothed unless a light was taken when one went to her. I shall discuss this point of fear of the dark more fully under the head of Fear; but as far as it was especially connected with waking, it seemed to be mainly an acquired fear, due to her having always gone to sleep with a light in the room, so that when she waked the conditions were strangely changed from those of her last waking consciousness, the people and things she knew had disappeared, and she had had no experience to lead her to think of them as still present, as she would have done had she been accustomed to the dark while awake. She waked, so to speak, to find herself lost in the darkness. It seems to me desirable on this account, if no other, that babies should be put to sleep in a dark room.

During the fifteenth and sixteenth months I find no note about

her behavior on waking, and in the seventeenth one or two references to her waking very sunny in the morning, spilling over with jollity and activity, when the night's sleep had been long and full. She would be notably clear in mind after such a waking, recalling her small vocabulary with facility, and talking more than usual. After a daytime nap, on the other hand, either distressed crying or a condition of timidity and mental arrest seems to have been common (though my notes are not full or explicit on the point). One afternoon, at the beginning of the nineteenth month, she had just waked from a nap, and was sitting on her mother's lap when I came in from the city. She greeted me with a habitual and almost mechanical question of "Papa?" (he sometimes returned on the same train with me and sometimes not, so that it was a regular subject of inquiry), but paid no farther attention to my entrance. Presently her grandmother kissed her: on which she put up her lip and almost cried, — not peevishly, nor in annoyance, but in a pathetic way, as if her feelings were hurt. I tried it, and then her mother, with the same result. She would not look at us nor heed questions, but sat looking absently before her, eating a cracker (she had waked hungry) and seeming as if her brain were dormant. At last something we said to each other interested her, and she slowly came out of her absent condition and became like herself.

At the beginning of the twenty-first month, her fretfulness and crying on waking from a nap were surprising: the 611th day, for instance, she lay in my arms for many minutes, breaking into crying at the least crossing of a whim, — *e. g.*, having been given a cracker, she asked for "one in the other hand;" her mother broke the one she had in two, and put a piece in each hand, as an easy way of gratifying the fancy, (which was common at the time and did not seem to be any wish for a double amount of cracker, but merely regard for symmetry); but the child broke into violent crying, and could not be consoled until another cracker was brought. Such crying, I noted at the time, was never heard from her except just after sleep and when her mother was trying to put her to sleep. Later in the month, the 621st day, I stood beside her when she waked from a nap, and had my arm about her before she was fairly awake. She did not cry, nor show the frequent distress and fretfulness; but seemed to go through a stage of confusion and

discomfort in waking, staring in a startled way; rose to her knees with her eyes shut, putting her hands to her face and moving blindly and bewilderedly. Yet she had no hesitation in recognizing me, and came to me cheerfully, asked for her mother, but not urgently, and when her mother came, wished to go to her, and clung about her neck a little, but without fretfulness.

In spite of the peculiar clinging dependence that appeared when she waked crying, I had not hitherto seen that the sense of need had attached itself exclusively to the mother. In the thirteenth month (379th day), waking in the evening in her mother's absence, the child had allowed me to take her without any timidity, clinging to me amid her crying, and kissing me over and over, — though after she was fairly awake and occupied with something, she stopped to say plaintively, "Mamma!" From that time up to the twenty-first month, the general effect of my notes had been only that she was apt to want her mother at such times, and to be very shy of strangers. But on the 626th day, waking from a nap in her mother's absence, she cried in good earnest for her, and when taken upstairs and offered her favorite diversions, she turned from them in a few seconds to urge "See mamma!" and broke into a wail when told mamma was coming back, which she well understood as implying that for the present she was gone. On this occasion a loquat finally consoled her; but for a fortnight more I find notes that on waking from naps she will have nothing but "mamma!" and seems to find the world desolate if she cannot have her instantly. Yet her mother's presence did not allay the trouble: even in her arms the child would cry in a distressed way.

Meanwhile a habit of crying wildly in the night had begun, — I can hardly say how far back, as I was not with her at night, but certainly by the twentieth month. One night in the latter part of that month, I slept with her mother, and took careful notice of one of these fits of crying. It was in a strange place, but I could not say whether that had anything to do with it, for she often cried in the same manner at home. She asked almost at once for the light, and her mother said that whenever she waked in the night, if the light was not promptly lit she would get to crying thus. After she was somewhat soothed, she lay for nearly an hour and a half dozing lightly, ready to wake and cry if her mother removed the arm about

her. In the morning her first words were, "Light! aunty make light!" pointing up to a corner of the room. I concluded that she had seen the light striking there from the candle, which I had set on the floor, and wondered if it had seemed to her uncanny. It was evident that she had not been too confused in mind to understand what I was doing. If fear of solitude (which the darkness seemed to create about her) had anything to do with her behavior, it vanished by day, for when we went out, she scampered fearlessly about the strange premises, preferring to run off alone to long distances, without the slightest timidity.

In the twenty-first month I again had an opportunity to observe the night-crying. She was in camp in the redwood forest, and I slept two nights in the tent with her mother: the first night she waked and cried for almost two hours, clinging to her mother and wailing, "Mamma, mamma!" crying outright, quieting, and breaking out again; her mother said it was her usual behavior in these crying fits. The next night she waked when I was alone with her, her mother having gone with a lantern to pilot her father across the stream from the midnight train. I expected trouble, but she allowed herself to be quieted with unusual ease: at first she was not altogether satisfied with my assurance that mamma had gone to find papa at the choo-choo cars, but the engine fortunately whistled at the moment, and she accepted this as evidence, observed contentedly, "Bi' b'ow' bea'!" (Big brown bear, an interesting denizen of the little railroad station, whom her father took her often to see) and after a little more nestling about, a whimper or two, and a few more murmurs of "Mamma!" dropped asleep in my arms, her head pillowed on my neck. Waking twice later, she allowed herself to be quieted easily by her mother.

During the last quarter of the year, after the camping trip, there seems to have been a good deal of improvement in the matter of crying at night, and fretfulness after a nap. The last night of the year, as recorded above, her mother ventured to leave her all night, and when she awoke in the night she accepted her father instead with no great discontent, though she cried a little for her mother.

The crying fits did not cease entirely, however, even in the third year. The first time that she was left entirely to me at night, after going readily to bed in my charge, as related above, she waked in

a couple of hours, crying wildly, — not for her mother, nor with any discernible cause. She would make no answer to questions, would cry and fall asleep, wake in five minutes and cry again, shedding copious tears. There were perhaps four such spells, in one of which she groped about and sobbed for “Boo-be” (Bluebell, the doll), but beyond this she would say nothing but, “No!” when asked any question or offered any comfort, — a drink of water or even a piece of candy, which she pushed from her mouth. At last her grandmother, who had come in, asked if she would come and be rocked (a way of going to sleep that she had gladly given up months before), and she put out her arms and went readily, and soon dropped asleep, but sobbed in her sleep for twenty minutes or more. She seemed half asleep all the time, and only opened her eyes once. On one other night, during a week that she slept beside me at the end of the twenty-fifth month, she waked crying this way, but was easily soothed. On both these occasions she had no nap during the day. On the other nights, though she waked from time to time, she showed no fear or trouble.

In the middle of the twenty-sixth month, she slept beside me again for four nights. The first night, she cried once on waking, but quieted as soon as I took her into bed with me; the second, she roused repeatedly, not waking, but with a whimpering cry in her sleep. In the morning, she waked with crying, and I noticed that the first cry was *before* she waked, so far as I could determine; so that it was impossible to attribute her distress to fear, or sense of loneliness, in finding herself awake before she realized that she was with some one.¹ She cried several minutes, till I had diverted her with cheerful talk, about the little birds. The next night she slept about eleven hours and a half without really waking; she roused

¹Such wild and unaccountable crying at night is attributed by medical writers to “night-terror,” akin to nightmare, due to sensations of suffocation from impeded circulation; and such a cause — or perhaps more general discomfort of sensation — would account well enough for the kind of feeling now shown; but it did not appear to be in any proper sense terror, — rather a completely diffused *distress*, which she herself was unable to refer to any grievance. Fear would have been more readily relieved by companionship, for instance. It is not easy in describing it to define differences, but it seemed quite clear to me that there was now, at least, however it had been earlier, no discernible element of fear.

and murmured "Auntly!" two or three times, or uttered a slight whimper, but when I put my hand on her, or spoke encouragingly, she dropped off at once. Waking in the morning, she sat up and looked about her silently, then cried out that she heard a little bird. She was perfectly sunny and happy. The next four mornings, her mother told me, her first word on waking was that she heard a little bird, or that the little birds had waked up and gone to find some seeds for their breakfast.

At the end of the thirtieth month she slept beside me for five nights. The first night she slept through without waking, and in the morning opened her eyes, looked at me, lay silent for some minutes, apparently perfectly content, then hearing a quail call, — "Auntly, the little birdies are waked up!" She declined to come into my bed, and after talking a little of birds, lay quiet and happy in her own bed till time for her bath. In the succeeding nights she several times cried on waking, without perceptible cause; once with heavy sobbing aloud; but she was always easily quieted.

I find no record of exceptional timidity and trouble at night after this, and though even in her seventh year there have been cases of night crying, it has been quite clearly referable to dreams or unpleasant thoughts. The liability at night to the recurrence of unpleasant or terrifying imagery from anything heard during the day has been quite noticeable. She is not at all a timid child, and likes stories to be very sensational by day, but sometimes has unpleasant recurrences of them at night: "I am not *afraid*, but it is *very disagreeable*," she says.

Two curious instances are recorded of bewildered crying, similar to that which was common on waking, but in the period just *preceding* sleep. In the last week of the twenty-seventh month, as I have mentioned above, she had gone very cheerfully to bed in my care when her mother was going out for the evening, but on her mother's coming in to kiss her goodnight in bed, began to cry for her, and cried hard. After being quieted once or twice and breaking out again, she began to beg wildly that I would dress her and take her downstairs; she was very sleepy and bewildered, and in trying to get out of bed scrambled blindly against the head of the bed, and tried to climb it; she had ceased to cry for her mother and cried only to be dressed. At last I took her from the bed,

rolled her in a quilt, and sat down by the window with her, showing her the moon, and she quieted and dropped to sleep in my arms. Twice during the evening she waked again crying for her mother, but was easily quieted. In the latter part of the twenty-eighth month occurred a still more curious incident; her mother came home on a late train, after her bedtime, but she was allowed to stay out of bed till she came; when her mother came in and took her in her arms, the child, who had asked for her several times, began to whimper and cling to her, saying, "I want my mamma!" and when put to bed, got to crying hard, saying she wanted her mamma, even when her mother held her in arms, and cried most of the time for two hours, then dropped asleep, but waked every half hour or so and cried. Such an incident seems to suggest that in apparent crying for her mother at night, the grievance may be a sort of symbol, a vague expression of feelings of loneliness and timidity which she does not understand. Her condition of health was not quite perfect, which would increase her normal susceptibility to such emotions at the time of sleep; or it is possible she was affected by the knowledge that her mother was going away on the morrow for a few days, though she had not seemed to mind it at the time she was told.

In the third as in the second year, the feeling of peculiar dependence on her mother seemed connected with the time of waking, rather than of going to sleep. The first two mornings that she slept beside me, she cried for her on waking, though she had not missed her on going to bed, nor in the night; the third morning she asked for her, but quite resignedly. The other mornings of this sojourn she waked cheerfully, without talking of her mother: once her first thought was to greet her doll joyously; another morning, as it grew dimly light, instead of calling my name, she crept over close to my bed and put her hand on my cheek, and when I waked and spoke, clung about my neck, patting my hair, — showing by this unusual demonstrativeness the feeling of special need of companionship in the waking hour. Once in this week she waked crying from a short nap, and coming to the foot of the stairs, begged and called, "Aunty, come down!" In most instances she accepted me thus readily as a substitute for her mother even on waking, but not as easily, on the whole, as in going to bed. During

her second stay with me she waked once toward morning and cried for her mother a long time. She would chat happily with me about the little birds, etc., but begin to cry when she thought of her mother. There was perhaps a little upset of digestion that increased her sensibility. An incident later in this month showed how deep an association of desolation she had with the idea of waking up and crying in vain for mamma: a book had been given her in which was a little picture story of a baby who waked up and cried in her mother's absence and was cleverly tended by a little dog. Instead of being pleased, she found it deeply pathetic, put up her lip and nearly cried over it, — a striking sensibility, as she was hardly at all susceptible to imaginative sympathy. Hearing me tell her mother of it, she almost cried again, repeating, "Mamma, baby did wake up and cry, and mamma didn't come!"

During an absence of her mother at the end of the twenty-eighth month, she cried bitterly for her the first night, but was soon talked quiet and asleep; the next night she fretted very little for her. The first morning, on waking, she looked at me till she was satisfied it was I, then sat up and looked anxiously beyond me in the bed, and seeing no one there, began to cry for her mother. I lifted her into bed with me, and she climbed over me and examined, to make sure there was no mother there, and then broke out afresh; the next morning she cried a little for her mother on waking, but was easily diverted. The five nights that she was with me at the end of the thirtieth month, there was no crying at all for her mother. The next time, in the latter part of the thirty-second month, she once murmured, "Mamma!" longingly in the night. After this she became quite accustomed to accepting me at night, from time to time.

It was only in connection with sleep, especially with the waking from sleep, that an insistent sense of need for the mother seemed to be felt during her absences. During the day, she was occasionally asked for rather wistfully, but not greatly missed on the whole.

From the first time the child slept beside me, I had accustomed her to as much darkness as possible, shutting out even half-light while she went to sleep, though staying close beside her. She had been used to going to sleep with a light in the room, and as early as the eleventh month had refused to go to sleep in the dark. She

now soon became reconciled to it, however, and the first night of her second sojourn with me she objected to my lighting the candle if she waked in the night, and wanted it put out: "Make dark, aunty, make dark!" The next night she asked to have it made perfectly dark when I put her to bed. In the first week of the twenty-seventh month she slept beside me for two nights, and insisted on my blowing out the candle as soon as possible, declaring, "I like dark!" Both nights she seemed anxious all night to get as close to me as possible, creeping into my arms, pressing her face to mine, tangling her fingers in my hair. The second night she came creeping into my bed in the night; I laid her back in her crib as soon as she was asleep, but she would from time to time rouse and begin to cry, and I would find her pressing toward me till she bumped her nose against the side of her crib, and when I would lean over to her, she would cling about my neck till asleep, stirring even half asleep and clinging tighter if I moved. In the thirty-second month, she objected to being left alone in the dark while I got her a drink, and wanted the candle lit during my brief absence from the room.

I have been carried far afield by this subject; and the fact that I have been, makes in favor of the belief I have mentioned, that the roots of the emotional relation between mother and child are struck mainly in the association of her with the vaguely but intensely susceptible states that border on sleep. I have been unable to exclude a good many notes that concern the emotions, especially fear and affection. No such wide relations belong to the subject of Hunger, for instance: the mother as the source of food does not record herself in the baby's nervous system in any such manner, to my observation, as the mother as companion and refuge in the valley of the shadow of sleep. The very marked increase in my niece's affection for her mother and longing for her at night, visible about the twenty-seventh and twenty-eighth months, was coincident with the placing of her crib close beside the mother's bed, and the free climbing over and clinging to her. The first keen imaginative sympathy with an emotion took its root in this region of experience. And the more closely I watched and tried to interpret the child's conditions of sensibility at night, the more striking seemed to me the analogy between them and some of our own most deep-seated

and poetic, but vague, emotions, — an analogy, indeed, more or less recognized always in literature.¹

A few more definite indications were noted as to the extent or kind of confusion in sense and memory that accompanied the waking moments. Once in the nineteenth month, the child in waking rolled off a narrow lounge, head first, and stood on her head a second: I had sat by her, somewhat expecting it, and had her in arms at once, and I do not think she took her brief inversion into consciousness at all. I have already told under the head of Color the incident of her returning asleep after an absence of six and a half days, in the twenty-fifth month, waking, and murmuring half asleep as her eyes rested on me that I had on my brown dress; then, looking at her mother, "Mamma, you need other dress" (*i. e.*, want it, choose it, have it on, — you have changed your dress). When she slept with me I did not, even from the first time, notice any confusion or difficulty in locating herself on waking: after the first two nights, she would murmur, "Aunty!" at once when she woke, or even when half asleep; and going back to her mother, she went back without a single slip to "Mamma!" the instant of waking.

In the twenty-sixth month, her father and mother, returning from a two days' excursion, changed cars while she was asleep, and I, chancing to take the train, saw her wake up in these changed surroundings. She sat up, staring about her wildly, and into my face as I sat opposite, without a sign of interest or recognition, much as if I had been a bedpost; threw herself back on her mother's neck, sat up again, and so several times, gradually waking; finally, pointing before her, "Mamma, this is n't our car!" For about a half hour she paid no attention to me, had little to say, and seemed sleepy; then rather suddenly wished to come to me, and flung her arms around my neck with much affection, — possibly remembering suddenly that she had not seen me for two days. At what point she recognized me, or whether she did so from the first, she gave no indication. I often saw her wake after a nap and stare

¹ The familiar quotation from *In Memoriam* occurs at once to every reader:

But what am I?
An infant crying in the night, —
An infant crying for the light, —
And with no language but a cry.

wildly around. Other instances of gradual or confused waking occur above.

In the twenty-eighth month occurred something that seemed to show that sleep obliterated memory of the immediately preceding time to a considerable extent: the child had spent the evening at a Christmas tree, but the next morning she could recall nothing of the evening, covering more than two hours before she went to sleep. Some fragments of it could be recovered by questioning, but most of it was gone. The whole two hours had fallen after her usual bedtime, and during a good part of it she had been tired and sleepy, but she had shown some enjoyment and interest. Some months later, she went to sleep on the way home from the Park, but when some one asked her immediately on waking what she had seen at the Park, she answered promptly, "You must n't ride on the baby donkey," and seemed to remember the whole visit pretty clearly.

A curious illustration of the sense of epochal lapse of time that a night's sleep probably gave her was given after she had had a heavy fall and bruised her lip terribly. She had been assured during the first day that if she was patient it would be better by and by: the next morning on waking, she put up her finger to feel the lip, and broke into a disappointed wail: "It 's sore yet, mamma!"

It is probable that her own attention to the idea of sleep began quite early, and that she knew in some sort what was to come when she first began to show resistance to being put to sleep. Her consciousness of it, of course, must have been limited to the incipient stages and the waking, like any one else's. The directions "go bylow," and "go to sleep" were obeyed in the thirteenth month by laying her head down as if pretending to go to sleep: and from the twelfth month to the eighteenth she was devoted to playing something that appeared like a pretense at going to sleep, — laying down her head on a cushion or pillow, or perhaps lying down bodily on the floor, to pop up laughing; by the fifteenth month she would carry a cushion about, and put it on the floor here and there to lie down on. In the fifteenth month, if she was told to "sing," she would utter a little crooning note or two, and put down her head, as if she were being lulled, — singing being associated principally with lullabies.

Toward the end of this month she began to say "By-y!" when she saw the rubber nipple she went to sleep with; and in a few days it became evident that the word meant *sleep* or *lie down* in quite a general way: *e. g.*, as her doll lay on the cushion, — "What is dolly doing?" — "By-y," — she is asleep. In the first week of the sixteenth month, she said, "Shlee-ee!" on seeing some one yawn. In the seventeenth month, as she trotted about with her favorite play of lying down on cushion or floor, she would say, "By-y!" and "shee-ee!" (bylow, sleepy) as she laid herself down. Once in this month (489th day) she said of an invalid who lay on the lounge all day with his books, "G'ee' — by — boo'," (Mr. Greene lies down and has books). Again, seventy-third week, seeing the dog lying still, she observed, "By!" In the eighteenth month *by* and *shee* were used interchangeably for *sleep*; but on the whole *by* was the regular word, and *shee* oftener meant *sleepy*; *by* would be used if she saw the cat or dog lying asleep. At twenty months I note, "Aunty wake up," "Cousin little Isabel wake up too." In the same week I asked her, "Where is that nap Ruth ought to have had?" At first she did not understand, but when I repeated, "That nap, — when Ruth shuts her eyes and goes to sleep, — where is that nap?" she answered, "Gogn way." — "Why, where has it gone?" — "I' be'" (In bed), — and in this answer she persisted, declining suggestions that she should go to bed to find it. In the twenty-first month she used "wake up" with a clear distinction between transitive and intransitive, "Wa' u' owgu!" (Let us go and wake up aunty); "Owgu wa' u'!" (Aunty has waked up).

As late as the seventh month, she did not shut her eyes in playing at bylow: but in the twenty-first, asked what eyes were for, after once answering that they were to look, she said a second time that they were to "go by," — to go to sleep. In the twenty-fourth month, when her doll's eyes fell out (or in) her only comment, her mother told me, was, "Dolly can't go bylow." In the twenty-seventh month, coming to me with her doll in her arms, she said suddenly, "Aunty, Bluebell does n't go to sleep." — "What, not at night?" — "No." — "And does n't little Jenny?" [her other doll] — "No," — very positively, shaking her head. "Why, the birdies go to sleep!" I said, intending to lead her to speculate on the difference between animate and inanimate things. "Yes." — "And Ruth goes

to sleep." — "Yes." She seemed puzzled, but easily left the subject. It is probable that she understood by "sleeping" nothing more than closing the eyes: indeed, after the close of the third year, I saw some strong indications that this was so. She had thus far had no experience of dolls that could shut their eyes.

Not to separate the subject of Dreaming from that of Sleep, I add here the few notes I was able to make concerning Dreams. I was not disposed to believe that the child dreamed early, and did not attribute such actions as sucking in her sleep (which I saw in the fourth month) nor the waking and crying, nor even some whimpering in sleep, to dreams, since it was quite possible that all these things were direct results of sensory conditions, without any cerebral action. The first distinct evidence of dreaming seen by either the mother or myself was in the last week of the fourteenth month (423d day), when the child called in her sleep, "Owgng! owgng!" (Aunty). Again in the eighteenth month (535th day), the mother told me that the child, waking in the night, had immediately asked, "Do!" (Outdoors), — a request hardly comprehensible under the circumstances unless suggested by a dream.

In the first half of the third year I saw no evidence of dreaming, but her mother said she undoubtedly dreamed more or less: in the thirtieth month she told me that the child, waking in the night, had said, "Mamma, Aunty May's little baby can walk!" — "Yes, darling, by and by she can walk." — "No, mamma, she can walk *now*." Other instances were also given me, which I failed to record.

In the thirty-second month, as the child slept beside me, I heard her speak several words clearly (I did not catch what they were), and leaned from my bed to see what she wanted, but found she was asleep; and as I leaned down, she laughed aloud. The next night, when to all appearance asleep, she suddenly said distinctly, "Pi-ta-toes," — a pause, then, "No, not pitatoes, pe-ta-toes." Here was clearly dreaming, but whether it was rare or customary, I could form no idea, nor whether she remembered and believed in the dreams.

At some time within a week after this must have occurred a dream that gave light on the last point, — a dream about a bull, of which she had become slightly afraid. She murmured something

about him in the night; and when next she came to my room to sleep (thirty-third month), she asked, "Will that old bull come here to-night, aunty?" When I assured her that bulls never came into the house, she insisted that once he did. She talked in her sleep that night, but I could not catch the words. In the thirty-fifth month she still insisted that the bull came one night to that room, and had it a good deal on her mind in going to bed the first night of each sojourn with me. Indeed, as late as the thirty-seventh month she still recurred to it, saying, "Once there was an old bull up here, aunty," but was now easily shaken in the idea. I tried to explain to her something of what a dream was, but I have no idea that she understood at all. I never saw her show any curiosity about her dreams. That of the bull was probably remembered only because it blended with certain waking memories, merely distorting them a little (it is likely that without such backing her dreams were too filmy and fragmentary for memory): the bull had, in fact, rushed up on the veranda, trying to escape from the men that were leading him.¹

DREAMING IN THE 4TH-6TH YEARS.

I append here my notes on Dreams during the next three years:—

One night in the 37th month the child several times laughed aloud very merrily in her sleep. The next night she waked and asked, "Has my mamma come?" — "Not yet," I said. — "But I saw her!" said the child; and repeated it once or twice in a puzzled way. The next morning I asked her about it; did she think she saw her mamma last night? and where? "Coming in at the door," she said. It was evident that she was not romancing at all, and was still unable to distinguish between the dream and reality.

About two weeks later, in the 38th month, the mother told me that waking from sleep the child had said to her, "I killed it, mamma!" — "Killed what?" — "De bad sing. I killed it wiv dis," holding up her little empty hand; then dropped off to sleep again. She showed no sign of fear. Early in the 41st month, however, she waked in the night and scrambled desperately into bed with her mother, and refused to be put back into her crib, saying there were bad men in the room, — papa said so. She scrambled over to her father and clung tightly to him. In the morning she had forgotten all about it, and was sunny and bold as ever.

In the 48th month, waking in the night, she asked, "Ma! — How do you think Thad kills mice?" — "How?" — "He pulls their teeth out." A pause,

¹ The first indication of dreaming in the case of Mrs. Chapman's boy was in the latter part of the 12th month, when toward morning he rolled over in a light sleep, murmuring, "boom, boom," (book). He then settled down in a deeper sleep.

then, "Once Margie and I saw a Jap kill a mouse that way." — "No, you did n't," said her mother. — "Yes, *we did!*" insisted the child. — "No, you never saw any one kill a mouse that way." — "No, not that way, but we saw a Jap kill a mouse by stepping on it." After a pause: "Mice do lots of harmness, don't they, ma?"

Here was probably a combination of dream and distorted memory. It is likely that her playmate, Margie, had told her of the killing of the mouse by the Japanese; I could not find that she had ever had any opportunity to see anything of the sort; and there was no Japanese workman on the farm. In all these dreams of the fourth year the influence of waking experience was more or less traceable. The gruesome nature of some of them corresponded to some timidity that during this year developed in waking hours, beginning with her fear of the bull at three years. She did not yet seem to understand the illusory nature of dreams, though they vanished readily from her memory with daylight, with the exception of the one about the bull.

Early in the fifth year, however, she began to tell of her dreams, and in a way that showed she understood them to be illusory. Those she told were quite commonplace: *e. g.*, she dreamed she saw an old woman driving a turkey; she dreamed she saw the cars go by, right along our carriage drive, — an incongruity which she laughed at; she dreamed she saw a gull fly into the cabin of the ferry-boat. She had often seen the gulls flying around the boat. These dreams were all in the 50th month; and in the last week of the month she dreamed she had a trumpet, and aunty took it away from her and put the end in the fire; she began to cry, and aunty took it out and showed her it was not hurt, — it was only a joke. Where she got the idea of an unkind joke I could not tell, — certainly from nothing in her own experience.

In the 53d month she told us that she dreamed some soldiers came, and they were going to kill her, because they said she was going to steal something. "And I said, 'I don't want to take any of the dried fruit,' so they let me go." She had been at the fruit-drying establishment the day before, and had asked for some fruit: possibly some thought of less lawful means of obtaining it had crossed her mind and colored her dream. During the great railroad strike, half a year before, she had seen squads of soldiers sent out to keep the peace, and had stood in some fear of them. She seemed troubled by this dream, and complained a week later that she kept thinking of it.

In the 54th month she related that she dreamed there was a pen full of squashes, and she was looking over at the squashes, and she saw a big black snake among them, — just the tip of his tail sticking out; and she knew if she got on his back and kicked him with her heels, he would give her a ride; so she got on his back and kicked him, and he gave her a ride, clear up to the cherry trees. I suspect that Mowgli's friend, Kaa, must have been the original of this accommodating snake, but cannot identify exactly enough the date at which she made Kaa's acquaintance to connect him definitely with the dream. Her first snake acquaintance, Nag, in Rikki-Tikki-Tavi, was not at all likely to inspire such a dream.

When a little over five and a half years old (67 months) she waked whimpering a little, said she had had a bad dream, and asked to sleep with me till

morning: she said if she got back into her own bed she would think about it. In the morning I asked her about the dream. She said she dreamed there were some green ants with a kind of clubs, and one of them hit mamma's head and knocked it off; then she [the child] begged them not to kill her, and they did n't; and she begged them to put mamma's head on again, and at last they did, and mamma was all right.

This dream seemed so probably due to fairy tales that she was told we must have no more except gentle and pleasant tales at bedtime. The child's firm nerves and unexcitable imagination had led to a good deal of carelessness in this matter, and for months she had had such stories as she asked for — often Grimm's tales — at the bedtime hour, without showing any ill effect till now. The change to milder ones effected, she twice again dreamed: once something commonplace, which escaped my memory before I could record it; and once that there was a pond in the garden, and she and mamma went out on a tongue of land that extended into it, and picked flowers happily. This dream was quite accordant in spirit with the stories I had been telling her at bedtime.

I watched her dreaming for some time, but except on these two occasions she said she did not dream at all; and this was, as far as I could ascertain, the rule. Up to seven years old, she insists that she hardly ever dreams, and now and then mentions having had a dream as a rare and interesting occurrence. Yet I think it probable that some drifting images occupy her sleep, or at least that her consciousness does not sink below the level at which lapse of time can be perceived; for once, late in the seventh year, she was greatly surprised on waking without having had this sense of the passage of time, and exclaimed over and over, "I thought I had just gone to sleep, and the very next minute I was awake and it was morning!" She must have had this consciousness of lapse of time during sleep even in the third year (p. 293, above). But that dreaming has always been rare I feel sure. I have on inquiry been told repeatedly by people of more physical than mental activity that they scarcely ever dreamed. It is likely that in primitive times dreaming was quite rare, which would naturally tend to enhance its mysterious significance.

I was well satisfied that my niece never at any time invented dreams; nor after she was four years old did she ever confuse them, that I could detect, with waking thoughts or memories. At seven years old she can even distinguish between a dream and waking imagery in the middle of the night. At this age she waked me one night by a cry that brought me quickly to her side. She seemed annoyed and abashed when she found me by her, and would not tell me what was the matter; and when I asked if it was a bad dream, said she did not think so, — only thoughts. She would not come into my bed. In the morning, however, she consented to explain: it was black cats, she said; she kept thinking of them, as if the air was full of them; it was n't a dream, only thoughts; and she thought perhaps if she called out, it would make them go away. A more imaginative child, doubtless, would have experienced far more confusion between dreams, subjective imagery, and realities.

SPONTANEOUS MOVEMENTS.

THE typical movements of this class are those vague and un-co-ordinated ones which appear in the new-born child (indeed, as Preyer points out, they are only continuations of intra-uterine movements), and which seem to be entirely aimless, unadaptive, and independent of peripheral stimulus. Preyer gives them the name of "Impulsive" movements, but the word "Impulsive" is used by English psychological writers in so different a sense that I prefer the one used by Bain, and adopted by Baldwin and Mrs. Moore, viz., "Spontaneous." The description of these movements given by Preyer corresponds with my own observations. He attributes them to random jets of energy disengaged by the mere growth of the lower motor centres: and they seem to me of such character as to be reasonably accounted for by this theory. Although I have called them entirely unadaptive, there is (as Preyer points out) one consistent tendency in them, viz., toward the resumption of the pre-natal position: but this does not in any way conflict with his theory of their origin, since the motor energy, disengaged without any guidance, would naturally find oftenest the channels already somewhat worn, so to speak.

I have already given, under the head of Muscular Sensation, (pp. 179, 180) my observations concerning the purely spontaneous movements, and the manner of their inhibition by more adaptive ones. By the end of the first three months I had ceased to see any movements that I thought purely spontaneous.¹ There were, however, movements of a mixed or transitional character, which are best classed here.

In the first place, I observed that of the meaningless movements made by the baby from the earliest days, some appeared to be

¹ Some movements that might perhaps have been put in this category, I accounted for otherwise: the baby's flourishing of her rattle, and kicking out her legs as she lay on her mother's lap, I thought voluntary, for pure pleasure in muscular activity; wriggling when measured (92d day), a definite expression of discomfort; the vague fumbling movements that preceded grasping, primitive efforts to exercise active touch. Preyer thinks many of the early vocal sounds must be classed as "impulsive."

connected with slight variations in general sensation, and therefore were not of entirely central initiation. The facial grimaces and movements of the head seemed to be stimulated by faint discomfort, and the movements of the arms and legs by heightened general comfort. During the first months the irregular movements of eyes and limbs were always increased in the bath, and asymmetric eye-movements were seen there after they had ceased under other conditions. These irregular muscular contractions and relaxations are not to be taken (as Preyer points out) for true expressions of joy or discomfort, although the latter are for a time not easily distinguished from them. After the first six weeks, however, the usual expressive movements took on a definite and recognizable character. There still remained, however, instances of the mixed or transitional class of movements. Thus in the sixth week, when the baby was looking with most intentness at anything, she would pant in short, audible breaths, and make movements with her hands, — movements quite different from the ordinary flourishing of arms in expression of joy and excitement, and less co-ordinated than this; I saw these vaguer movements as late as the 80th day. In the seventh week, when in the bath, she moved her head from side to side all the time as she held it up, breathed rapidly, and pushed her feet against the foot of the tub; and while wiped made articulate noises, panting, her head turning from side to side, and arms and legs moving gently. The 47th day I took her up when she was crying for hunger, and noticed that she was doubling up and stiffening her body, — a movement that I never noticed at any other time. All these movements (excepting the pressure of the feet against the tub and perhaps the doubling up of the body), seem to have been due to an irregular overflow of general stimulus from sensation, and differed from several of the ordinary expressive movements only because the latter were better co-ordinated, and were regularly associated, each with its usual stimulus of feeling.¹ Such irregular expressions of feeling — overflows, so to speak, above the normal methods of expression — continue even in adult life: in extreme pain or mental distress, e. g.,

¹ In this regular association of the movement with the feeling, not only in the same infant at different times, but in different infants, we see evidence of an inherited, instinctive character even in very simple expressive movements.

all sorts of random movements — tossing the hand about, twisting the trunk, etc. — are resorted to by excitable persons to carry off the pressure on the nerve-centers. So too in annoyance, impatience, sometimes even in delight, various slight movements, as tapping with the feet, twisting the fingers, etc., are used for like purpose. The variety of movements used by the little child to work off a high pressure of spirits is illustrated in some of my notes under General Sensation (pp. 240, 242, 251). Such movements in adult life are to a certain extent conscious and voluntary, but not always; and they are never entirely uncoordinated, for with the increased definiteness of nerve-channels by this time, it would be impossible that the most random jets of energy should produce altogether uncoordinated movement. Even at two or three years old, and in sleep, the tossing and tumbling of a child (movements that are to a considerable extent spontaneous, though doubtless stimulated more or less by pressure of bedclothes, fatigue in one position, etc.) are more co-ordinated than the ordinary waking movements of a baby in the first two or three weeks: the accustomed groups of muscles work together in turning the body over, for instance, — a co-operation that never by any chance comes about in the earliest weeks.

Movements resulting from an excess of voluntary motor stimulus above what is necessary for the accomplishment of the action willed, so that a secondary action (involuntary and unadaptive) results, are a different class of the same general type as those just considered. Preyer calls them “accompanying” movements. Some curious jerkings and turnings of the head in the ninth week, associated with the effort to balance it, might have been of this class (see p. 327, note); the wild fluttering of the hands in sympathy when the baby was trying to reach an object with her lips (Grasping, p. 316) is a good instance.¹

¹ Accompanying movements in which there is any sort of adaptation, even of an irrational sort, as when a singer lifts the brows in reaching a high note, do not seem to me properly to be classed here. Such are the movements of keeping time to music, or crooning in listening to it (pp. 123-4), and the sympathetic doubling up of the body when a dive was made with the head for the purpose of seizing (p. 316); a similar doubling up of the body, also, which occurred when the baby was amusing herself by making vocal sounds, in the twentieth week, — she would suddenly *jump at* a sound, so to speak. It is

not always easy to determine whether an accompanying movement is due to a mere blind overflow of motor stimulus, or whether it is connected with the primary movement by consistent associations: but in proportion as they are found habitually occurring together it must be concluded that the connection is not a random one, and the movement is not properly to be called spontaneous. This distinction is parallel to the one I have suggested above between movements that are consistently associated as expressions with certain states of feeling, and those that merely express vaguely a heightened *general* excitability in the motor centers.

REFLEX MOVEMENTS.

Under this head Professor Preyer classes all movements that follow immediately upon peripheral sensation without the necessity of any central action, and along well-established paths. I made no especial effort to keep record of such movements, believing that to do so intelligently required more special physiological knowledge than I had. A few notes of the common reflexes were taken incidentally. Sneezing occurred at birth, and crying soon after; swallowing also on the first day; starting (at a sound) on the 3d or 4th day; winking on the 23d; hiccoughing on the 28th; coughing on the 42d. Yawning also is mentioned on the 42d day, but with the implication that it had been seen earlier: on this day, waking from a long nap, the baby yawned, stretched, and seemed to be rubbing her fists into her eyes, in a comically grown-up manner. Choking (in nursing) appeared early, but I have not the exact date, — certainly by the middle of the third month. Closing the hand on an object laid in the palm was also very early, — I believe from the first, though my record does not show it.

All these movements were as complete and co-ordinated as with any adult, the first time they were performed: yet it cannot be said in the case of all that the mechanism seemed to be at birth in perfect order and ready to work at the touch of the appropriate stimulus. Sneezing, swallowing, crying, starting, and perhaps choking, were the only ones of which this could be said; and even crying was not the more complex performance of later infancy, but a mere monotonous, repeated sound, rather a bleat than true human crying. Winking could not be induced in the first three weeks: sudden sounds caused either no reaction at all or a general start throughout the body, but never winking; in strong light the eyes were held tightly closed, but there was no winking; and as already noticed, a threat at the eyes produced no movement of the lids before the 56th day. This was of course partly due to the imperfect condition of sight and hearing, so that the proper sensory stimulus was not yet applied; but the reflex mechanism itself was also deficient, for the earliest winking responses were usually

remarkably slow. The variability of this response (as well as that of starting) after sound stimuli was probably due to variable sensibility to sounds, not to defects in the reflex mechanism (Hearing, pp. 107-8); when first seen in connection with visual stimuli the wink followed regularly, though slowly. In the case of hiccoughing, coughing, and yawning, also, it seems probable that the conditions which caused the movements did not occur for the first time when the reactions first appeared.

The yawn in the second month was always ended with a comical little throat-scraping sound, which I do not remember to have heard from any older person in yawning.

Early in the fourth month the baby became able to produce a cough voluntarily, but not by imitation of the natural cough; it seemed to be merely a sound hit upon independently in the course of experiments with the vocal organs.

The movement of rubbing the fists in the eyes, which I noticed (together with stretching and yawning, see above) as early as the seventh week, is noteworthy: for I am certain that with this exception the hand was never in the early months carried to the spot of any peripheral sensation. It must have been a purely reflex movement, for it was not before the tenth week that the hands were voluntarily guided to the mouth; and it seems odd that so unimportant reflexes as these should appear so early in a perfectly developed and remarkably complex group. The perfection and maturity of the movements were noticeable to the most casual observation, and had, as I have intimated, a comical precocity of appearance in so tiny a baby, — out of keeping with the rest of her behavior. Rubbing her eyes was repeatedly noticed afterward, but not stretching.

Other and less habitual reflex movements in the early months, have been noted under other heads, but may be repeated here.¹ On the 23d day the arm was once flung out at a sudden sound (the regular response being a wink or start); and in the last week of the third month, when I kissed the baby's hand suddenly, the little hand flew up as if a spring had been set off. Possibly the earliest smile for a specific cause was a reflex (it was excited by rubbing

¹ The remarkable turning of the head toward an interruption of the light, from the first day, is considered in the discussion at the end of these notes.

the upper lip), but I thought that it merely expressed pleasure, as smiles noted in the next two days undoubtedly did; it certainly was not a reaction following "along a well-established path." The grimace excited by novel sensations of taste (p. 160), was also an expression of emotion — that of surprise — but had much of the quality of a reflex. It is hard to say whether pushing with the feet against a surface that touches the soles (pp. 180, 189) is to be regarded as a reflex or a voluntary movement. The 121st day, when the baby was listening to music, and already in an excited nervous condition, I could feel her start and thrill in my arms every time a strong chord was struck or a vocal note accented heavily.

Reflexes were quite readily inhibited by diversion of attention: see under Hearing (p. 107) the failure to react to the stroke of a bell when nursing, 23d day; and the power of the piano and other diversions to check crying (pp. 108, 115, 149), from the second month on. Even sneezing could be thus checked, from the eleventh month: this was first seen on the 316th day, when some one mimicked the baby as she was about to sneeze, and made her stop and smile, losing the sneeze, exactly as it might have happened with a grown person. In this case, however, the diversion of attention may not have had so much to do with checking the sneeze as the movement of the lips in smiling.

INSTINCTIVE MOVEMENTS.¹

GRASPING.

From the first the baby would close her fingers, like all babies, on any small object laid in her palm; and the tendency of her hands to move upward, about her head and face (see p. 299), looked somewhat like an effort to reach her mouth; but these early movements must be set down as quite involuntary, as the later slow development of the same acts under volitional control shows. Neither intentional holding of an object, nor intentional seeking of the mouth with the hands, was seen before the third month, with the remarkable exception about to be related: —

On the 48th day, just after nursing, the baby lay in her mother's lap looking about, quiet and contented. I laid a pencil some three inches long in her hand, intending to see whether there was yet any indication of consciousness and purpose in holding. The hand closed on it at once (the thumb correctly reversed) and carried the pencil to the mouth. I had no idea that this could be more than accident, but pushed the hand away from the neighborhood of the

¹ I am quite aware of the difficulties of definition that surround the use of the word Instinct, and the uncertainty of the line between instinctive and reflex actions on the one side, and instinctive actions and personal habits on the other. It certainly seems a doubtful classification that separates a simple and primitive act like sucking from another simple and primitive act like swallowing, and puts it into the same class with walking, which the child inherits only as a tendency, and actually learns with as much individual effort as an adult employs in learning to use the bicycle. Sucking, biting, and licking plainly resemble the instincts of the lower animals, as the pecking of newly-hatched chickens, the standing of the new-born calf: they are inherited ready-made. The locomotor movements and grasping, on the other hand, approach the character of an individual acquirement that speaking possesses, — the one step that separates them being *the necessity of a model of language to imitate* before speech can be acquired, while we feel sure that an absolutely isolated child would begin to grasp and to walk when the time came. Yet this one step is, I think, the significant one. The locomotor movements are not only the same ones — homologous in nature — with those that we recognize as instinctive in the lower animals, but also they are not in a broad sense volitional and individual: though individual intelligence and volition attend their acquisition to a quite

face, lest the pencil-point should do harm in some aimless movement. To my surprise the baby *six times* carried the pencil directly back as I pushed it away; and as she did so she put out her lips and tongue toward it eagerly, with sucking motions, much as when about to be put to the breast, — looking, as was her habit when put to the breast, not at the object but vaguely before her. She held the pencil firmly for about three minutes, then her attention seemed to wander from it and her fingers relaxed. I could not get any repetition of the incident, either with that hand or the other: her fingers would close on it as always, but without attention, and would soon relax. It was weeks before the least attempt to carry the hands to the mouth could be detected again. Yet it seemed impossible to doubt that there had been an effort to do so on this occasion. I could only suppose that the first upward movement had been mere chance, but that the hand or pencil-tip had barely touched the baby's lips before I pushed it away, and that the association of this sensation with the muscular movement of the arm lasted long enough to induce the half-dozen immediate repetitions of the movement, but not long enough to create any fixed association group.

It is evident that the hand as an organ of grasping was not concerned in this incident, except by the inherited reflex that

remarkable extent, yet they are as necessary and racial in the child as in the calf: every normal child that is born must needs come to them, at about the same age and in somewhat similar manner. They have therefore the essential characters of instinct, as agreed upon by all different definitions of the word.

If we find on the one hand very marked instinctive elements in movements that are on the whole classed as volitional, and find on the other hand that such an action as sucking or biting occupies a ground almost intermediate between reflex and instinctive action, so that on either side of the field of Instinct some acts might be cut away or added, according to the exact definition that one uses, this only shows the more plainly that sharp lines of division are not made here by nature, — that the different types of race movements shade into each other. Even among undoubtedly reflex actions, which follow directly upon peripheral stimulus without any interposition of volition, perhaps not even of consciousness, according to fixed ancestral arcs of communication, there is every grade of volitional infusion into the act: thus, coughing and swallowing can be voluntarily produced, but only up to a certain point inhibited; yawning cannot be produced or inhibited by direct volition, but is notoriously subject to suggestion, while choking cannot possibly be inhibited by any central cause, nor under ordinary conditions suggested.

enabled it to hold fast the pencil. The mouth, however, was already considerably developed as a grasping organ, through its primitive function of sucking. From the fourth week the baby, if held against one's cheek when she was hungry, would lay hold on it with her lips and suck it. Signs of especial tactile sensibility in the lips, and even the use of active touch in the tongue, had already been noted (*Sense of Contact*, p. 136), but none in the fingers. Blind groping movements with the head when placed at the breast, in the fifth week, showed an instinctive disposition to co-operation of the neck with the mouth in grasping.

During the second month I saw further evidence of special tactile sensibility about the lips and tongue, in the baby's habit when not hungry of putting her lips to one's cheek, if she was laid against it, and licking it, instead of sucking, as she did when hungry. Meanwhile no special sensibility, even passive, appeared in the fingers till the beginning of the third month, when the baby had a habit of keeping her finger-tips together if they chanced to come into contact, as though interested in the sensation.

By this time — the beginning of the third month — she would keep her hands closed for several minutes (the thumb as well as the fingers) on a finger laid in the palm, though not on any other object. This seemed more like conscious holding, yet as will be seen below (p. 310) it was not till late in the month that I saw clear evidence of purpose and attention in holding.

She now began (ninth week) to make efforts to get her hands to her mouth. By the tenth week the fists were put to the mouth constantly, usually both at once, and whatever parts of them could get inside were sucked and mumbled. If they were taken away the baby would carry them back. When her hands closed mechanically on folds of her clothes or of the towel as she was wiped, these were carried along with her hands to her mouth and sucked; but there was no conscious attempt to carry objects thither. By the twelfth week she had learned to get her thumb into her mouth whenever she wished, and was fond of sucking it as she lay cozily against her mother's shoulder. If she lost it out, she usually tried to put her mouth down to it, instead of putting it up to her mouth.

When she had been diverted from the thumb for a little while, she would recur to it suddenly, making a dive of her head for it, and at the same time carrying it upward to meet her mouth. This dive for her thumb was her only sudden movement, and very comical, — as if she had ejaculated, "Happy thought, — to suck my thumb." The continuance of the movement as late as the fifth month is noted below (p. 316).

But though the precedence of the mouth as a grasping organ was quite evident here, the hands in this same twelfth week came rapidly to the front in consciousness, and by the end of the week had made visible progress toward grasping. The first sign of this was a trick of clasping and unclasping the fingers fumblingly on some surface, as one's hand or dress, evidently with intention, — an action which I could not attribute to anything but the exercise of active feeling, hitherto seen only in lips and tongue. Objects placed in the hands were held very firmly, though not looked at. The 79th day a large rubber ring, placed in the baby's hand and carried with it to her mouth, was held there for a minute or two while she mumbled and sucked at it. This approached to conscious holding. The next day, when bright napkin rings were rolled across the tray of the high-chair in which the baby was propped, she looked at them with eagerness, making indefinite motions with her hands, which might have had some sort of anticipatory connection with the impulse to seize, but which I regarded as merely accompaniments of cerebral tension, since such motions were not infrequent in connection with intent interest (see *Spontaneous Movement*, p. 300). On the 83d day, as the baby sat in her high-chair with rattles and other articles lying on the tray of the chair, I noticed that she kept fumbling on the tray with her hands, and that when she touched an article she would at once grasp and raise it, sometimes holding it for half a minute, but without looking at it or the hand, or showing any perception that the article she *felt* in her hand was the same that she *saw* when she did chance to glance at it. In picking it up, if it happened to touch her fingers conveniently in front, she would clasp it properly; but I noticed once that when the back of her hand came in contact with a rattle she had no idea of turning her hand, but got hold of the rattle backward between two fingers, and so lifted it.

Here was already developed suddenly a sort of hand-grasping, — the ability to lay hold upon an object when it was *felt* in contact with the hand; but it was nearly a month more before grasping at a visually located object appeared. In the interval steady progress was made in skill and conscious intention in laying hold of objects and raising them, and I watched and recorded every step of this progress strictly, feeling that it marked the beginning of an important epoch of development.

For some three weeks this progress in grasping all took place when the baby was propped in her high-chair and supplied with convenient objects on the tray of the chair, where she was doubtless already learning to grope for them. During the thirteenth week I find almost daily note of more skill in taking hold. On the 86th day the baby repeatedly picked up her rattle, which had a slender shaft easily grasped; and I noticed that when fretting a moment for some reason she did not hold the rattle, but relaxed her grasp at once, showing that the holding was now conscious, requiring attention. I noticed also that when holding the rattle and flourishing the arm she no longer flourished the other arm, from which I thought there was certainly volition in the action: the rattle was no longer merely held while the arms went through the customary movements of joy and excitement (in which both arms were always used), but was purposely shaken. There may even have been an association of this movement with the jingling sound, and a desire to produce it. Objects were not yet voluntarily carried to the mouth; but they were frequently brought up into its neighborhood by the motions of the arms, and once on this 86th day, when the rattle had thus come into the neighborhood of the mouth, I saw the baby try to put it in; she had it at right angles to the mouth with the rubber nipple on the end almost in, but at this point she was interrupted. The next day she not only took up the rattle with increased skill and intention when her fingers touched it, and shook it as before, but tried unmistakably and repeatedly to carry it to her mouth, — thus repeating for the first time the effort made with the pencil on the 48th day (p. 307). The shaft was so long that she could not get the nipple on its end into her mouth except by holding it diagonally; yet she accomplished it several times, very

clumsily. She fumbled for her mouth, sometimes thrusting the rattle against some other part of her face, thence feeling her way along with it gradually to the right place; three times she brought it up sidewise, so that a ring of little bells with which it was fringed touched her lips, when she would draw the little bells in and suck them. Her father was unable to resist helping her by placing the rattle in her mouth, so I could not judge what she would have accomplished if let alone. The difficulty she experienced in finding her mouth with it, compared with the ease and directness with which she could put her thumb in the desired spot, was noticeable.

Twice on first grasping the rattle she looked at it seriously for some time, but did not appear to connect its visual appearance with what she *felt* in her hand.

The next day (88th) she took up the rattle readily when her hand touched it, and turning the rubber end (probably by chance) toward her mouth, lifted it; it struck at the side of her nose about an inch above her mouth, and instead of moving the rattle she tried to reach it by stretching her mouth wide and moving her head. After a few vain efforts of this sort she lowered her hand and made a fresh start, — this time hitting her lips, where by stretching her mouth again she managed to reach the rubber and get it into her mouth, but awkwardly, in her cheek. Again her father could not resist coming to her aid, so I could not tell whether she would have righted it herself. After a little she lost it, then grasped it again and brought it to her mouth, this time the other end uppermost. This end had instead of the nipple a large sleigh-bell, fringed with small ones; and thinking it undesirable for her to suck the little bells, her mother took the rattle away to remove them, and the baby lost interest and would not renew her efforts when the rattle was given back.

She had a rubber nipple set in an ivory disk, with a movable ivory ring on the other side; this nipple she did not try to put into her own mouth, but held and sucked it when it was put there by others. This afternoon, having had it put into her mouth, she presently, in putting up her hand, got hold of the ring, grasped it firmly, and soon accidentally pulled out the nipple. This happened repeatedly, and she also lost it out in trying to laugh or shout while holding it.

During the rest of the thirteenth week the clumsy and rarely successful attempts to get the rattle into her mouth continued. Once when she brought the bell end to her mouth, being unable to get the bell in as she did the nipple at the other end, she began licking it.

She was now just three months old. Besides the power to lay hold on an object that touched her fingers and to carry it imperfectly to her mouth, she had showed some voluntary use of hands and arms in the effort to pull herself to a sitting position when holding with her hands to some one's forefingers, — an advanced movement rather difficult to understand at this stage, and apparently quite blindly instinctive, for it seems improbable that she should have formed any association between this pulling movement and the raising of her body; still, her mother had often lifted her by the arms in bathing and wiping. She would hold the forefingers tight and firm, and pull hard (see p. 328). This movement had been made for some weeks.

I now watched vigilantly for the first sign of any visual guidance in seizing; but for some time in vain. The baby continued to touch objects either by accident, or perhaps by fumbling for them, looking in some other direction inattentively; but the object once felt, she would seize it with clear intention and carry it to her mouth. If by chance her eyes did turn toward the object, it was with entire inattention. The 98th day, when pounding first with a rattle and then with her hand, with much violence (p. 144), she did not once glance at the rattle or hand; a few days before, when I kissed her hand suddenly and apparently startled her, though the hand flew up sharply (p. 304) she did not look at it; about the same time, when a visitor amused her greatly by kissing her fingers rapidly, though she smiled and cooed her eyes never turned from the lady's face to her own hand.

On the 99th day I noticed that she several times looked down at an object *while* grasping, but never before she had laid hold, and never with any appearance of attention. In the following week, (fifteenth) she quite commonly let her eyes rest rather blankly on her hands and objects in them after she had fumbled about till she

touched an object and while she was lifting it; then her glance would leave it, and it would be carried to her mouth by feeling only.

By this time her skill in taking things up had considerably improved: on the 105th day, for instance, I note that having brought her hands against a napkin ring that lay before her, she took hold of it neatly with both hands, one on each side, and tried to lift it. This shows a certain amount of co-operation between the hands: yet her understanding of them and their relation to her was plainly very slight: if in fumbling for an object they chanced to encounter each other, each would grasp the other and try to carry it to the mouth. She could carry a small object, as a rattle, quite easily to her mouth now; but was still embarrassed in getting it in by any difficulties in its shape; she would often then drop the object and resort to the ever-convenient thumb or fingers instead, with the same droll suddenness as before. Often in lifting an object to her mouth she would open her mouth in readiness, and sometimes would bend her head, — mouth and hands seeking for each other mutually.

In the sixteenth week her disposition to put things into her mouth and her skill in getting them there grew; and she began to take hold of objects elsewhere than on her tray: she would clutch at people's fingers or at the folds of dresses as her hands touched them, and pull them to her mouth. Yet she still understood so little the relation of her arms and their movements to the presence of objects in her mouth, that she constantly lost the rattle out of her mouth by trying to flourish her arms while she held and sucked it. She even lost her fingers out in the same way.

At just sixteen weeks old (113th day), she made a near approach to deliberate grasping: she looked at her mother's hand held out to her, and while looking made fumbling motions toward it with her own hand till she struck it, then seized it and tried to carry it to her mouth; and twice again the same day I saw her do this. She would not aim a grasp at the object, under visual guidance, but would look at it, move her hands vaguely, as if feeling for it, then strike them toward it with fingers open till they touched; then she would seem to understand what she was about, and take hold. She looked more than before at objects held

in her hand, but still vaguely; and indeed, the whole process had a vague and mechanical appearance, as if there were little volition about it. The 114th day she got hold of a good many objects by a kind of vague clawing at them, looking at them more and more as she did so.

But with regard to putting objects once seized into the mouth, the volition was clear: as far back as the 96th day her grandmother had seen her open her mouth while getting hold of her rattle, and now it was common; she would open her mouth and put her head forward as soon as she touched an object, even while fumbling to get a good hold, — but never at *sight* of it. The 112th day I touched her face, and she made many efforts to reach my touching finger with her *mouth*, moving her head to help, but did not lift her hand toward it.

The 114th day I tried the experiment of giving her a rattle in each hand, and she flourished both happily, though giving most attention to the one she had first, in the right hand. Later the same day, seeing her in high content, holding one in her left hand, flourishing and chewing it, I put another into her right hand: this time the division of attention seemed to trouble her; she made a pitiful face and began to fret, and was not happy till the intruding rattle was removed.

The 118th day occurred the incident that may be called the first real grasping, — if it is possible to fix the point in such a gradual development. I held the baby up before a picture on the wall, which she was accustomed to look at for some seconds with interest. The light shining on the walnut frame seemed to catch her eye: she looked at it, put out her hand a little uncertainly and waveringly, and first touched then took hold of the edge of the frame. I then brought her rattle and held it out some two inches from her hand: she put out her hand in the same uncertain way and took it. In the afternoon she had somewhat relapsed from this attainment: when the rattle was offered her she looked at it, making some sounds of desire, moved her arms vaguely, and finally brought both hands down about it, on either side; as soon as she touched it her movements became definite, and she laid hold of it and carried it skilfully to her mouth. This was the way that

at this time she took up articles from her tray, — bringing her hands down to them from either side with much uncertainty till she touched them; then she would lift napkin ring or spool, rattle or rubber doll, quite firmly to her mouth, often with both hands. I have seen her hold a napkin ring very nicely at this time, grasping the opposite edges with her two hands.

The next day there was no advance in seizing with the hands, but two instances of the more primitive mouth-grasp. The mother tried once more to see if the baby, when about to nurse, could find the nipple by sight, a thing she had never been able to do before; she found it now with lips and head quite easily, at a distance of some three inches, looking at it as she did so. In her baby-carriage she got her hands out from under cover, and taking hold of a fold of her cloak, put it into her mouth. As the day was cold I put the hands back under cover; when the baby, without trying to get them out, put out her *tongue* and made efforts to reach the cloak with it. After a little she gave this up and got her hands out again.

The 120th day (seventeen weeks old) I showed her a colored picture-book. She looked at it with interest and put out her hands to touch the pages, feeling till she got hold of the edge, when she at once pulled the book to her mouth. I then held it beyond her reach, and she stretched out both arms toward it as far as she could. Her grasping was still, however, to a great extent *feeling for* the object, without much dependence on visual direction: she would put out her hand with fingers lightly spread or curled, not prepared to seize, touch the object with the tips, then feel about it till she got a good hold.

As an instance of her skill in taking up an object from her tray at the end of the fourth month, I saw her on the 122d day take up a heavy silver napkin ring nicely with one hand, and carry it to her mouth.

With the beginning of the fifth month there was a perceptible advance in precision and confidence of grasping, yet the method remained the same. I watched it carefully: the baby would first put her hand uncertainly out with fingers spread and no appearance of intention to grasp, but looking at the object always; when she

had once touched it her motion would become more confident; she would feel about it till she had a good grasp, and then take it. There could be no doubt of the deliberate character of the action since about the time she took hold of the picture frame. Once, the 130th day, her grandfather came up to her and held out both forefingers, and she lifted her hands and laid hold on a finger with each hand quite promptly, but could not be got to repeat the action. She liked at this time (nineteenth week) to pull her father's and grandfather's whiskers: they had begun this by tangling her hands in their whiskers, but now the action was plainly voluntary. She did not thus far care much for grasping, her interest being centered in the use of her eyes and voice: nor did she show gayety in it (not even in diving at faces or pulling beards), seeming to regard it as solely for the serious purpose of putting things into her mouth; she would sit very quietly, looking about her and putting her rattle, ring, or spools into her mouth. Yet twice (129th day) she looked at her mother in a troubled way and put up her lip to cry on losing a heavy napkin ring she was trying to lift, — an unprecedented sign of disappointment.

She grasped with the mouth with more precision and promptness than with the hands, and really showed more disposition to use it. The 123d day, and again the 128th, as I held her in my arms, she turned around, and made two or three quick dives at me with her head, apparently to get the loose folds of my bodice into her mouth. When held near any one's face she would attack it, sometimes with a sudden dive of her head (accompanied with a sympathetic doubling-up movement of the body), and mouth it with satisfaction. She still dived her head to meet her fingers when at times she seemed suddenly to think of putting them into her mouth (at such times the fingers likewise were brought up with a jerk, though all other voluntary movements of the hands were slow). The 130th day, as she lay on her back, a rubber ring in her mouth fell out and lay around her nose, resting on her cheeks, upper lip, and the bridge of the nose. She made many efforts to seize it with her lips, stretching her mouth open ridiculously, but none with her hands, though they fluttered wildly in sympathy. When after some time she had tumbled it off with a movement of her head, she looked up at her mother a little

frightened, we thought; but when the same thing happened twice again she became familiarized with it, and after a little effort to get hold of the ring with her mouth, let it lie there.

I noticed this week also that she began to cling a little to us when held in arms, instead of sitting passively in our arms as in a chair.

At the end of the nineteenth week and in the twentieth there was a wonderful advance in skill and interest in grasping. First (132d day) I noticed increased promptness and precision in taking hold of small, familiar objects in familiar positions, and also increased skill in playing with a short rattle set on a rubber strip, by taking the rubber between her jaws and jerking it out with a twitch. Next (133d day), I noticed that she could always find a toy when she had dropped it on the tray of her chair, but not if she dropped it in her lap; in that case she would make a little wishful cry that always brought some one to restore the toy, — again to the discomfort of my observations, for I wished to see if she would not learn to find it herself. The same day in making one of her sudden passes with open mouth at my forehead, she made a simultaneous clutch at my face with her hands, and this was the rule for two or three days; then the clutch was made with hands *alone*, though the baby would afterward put up her lips to mouth our faces. The 134th day she held her rattle up before her as she lay on her back, and inspected it carefully. The 135th day she played with a call-bell with great interest, pulling it toward her and trying for a long time to lift it, with but partial success; the same day she held an envelope a long time, pulling it this way and that between her two hands without trying to put it into her mouth; the same day, too, she first reached for her toes, on having her attention drawn to them. She had been shown them once before, and had regarded them with interest but had made no effort to touch them; now she took hold of them without difficulty, and — which surprised me — flexed the foot forward on the ankle joint and brought it within reach of her hand in quite a skilful way, as though she felt her control of it; she did this several times. Later she reached for her toes more than once without suggestion, and also took hold of her leg repeatedly, as it was

kicked up before her. The 136th day she played assiduously with her feet and toes; and set down on the table, she tried quite hard to scramble forward to get at an object she desired, and reached for everything near her on the table. The 137th day she was deeply interested in playing with a call-bell, pulling it about, banging it down, etc. For two or three days now, though the hand was still put out for grasping slowly and cautiously, it was with the fingers held ready.

By the end of the week (twentieth) the desire to seize everything had become the baby's predominant interest. Moreover, as may be seen from the items of progress day by day given just above, it was no longer merely for the sake of putting things to her mouth that she seized them: finger-touch, together with the varied muscular experience possible through manipulation, seemed to be at last asserting itself as a source of interest against the sensibility of lips and tongue. The baby would "play" with many things, pulling them to and fro for a minute, then putting to her mouth. Whatever was shown that interested her she tried to seize, — pictures on the wall, figures on a tray, roses on the bedquilt. If an article did not move readily under her hands her mouth went down to it. Though very fretful for a couple of days, from a temporary insufficiency of nourishment, she would always stop fretting for some minutes when given a plaything.

The rest of the fifth month is a record of incessant interest in seizing and handling things, and of some increase in skill. The baby was absorbed in looking and feeling; she desired to look at and touch every object shown her, and others on which her eyes might light. She would stretch both arms out, taking hold on the two sides, and usually drew the object at once toward her mouth; though often she would pull it around awhile first. Her toes were always seized with great interest when she was undressed. A steel bell given her on the 146th day was at first pushed and pulled about on the table, and put into her mouth, — any part that came handiest, — but by the 149th day was rung with intention; she would shake it awhile, then put it into her mouth, then shake it again. The first time she was given food in a bottle (141st day) she took hold of the bottle readily and put the nipple easily into

her mouth; then (not liking the taste of the new rubber nipple) would reject it, look at it with interest and surprise, reach out her arms for it, pull it to her mouth and get the nipple in nicely, then go through the same process again. She wished to hold and manage the bottle entirely herself, but could not be trusted to tilt it properly. A large glass marble, perhaps an inch and a half or more in diameter, which she had failed to hold on the 140th day, she lifted nicely with both hands on the 141st and carried successfully to her mouth, seeming to appreciate perfectly that it was a slippery and difficult handful; she lost it easily, however, and did not care much for it. Later she picked it up with one hand, but could not keep it.

I noticed (147th day) that in taking up her bell she did not nearly always reverse her thumb properly, as when a small, convenient object was placed in her hand; nor did she always use her whole hand, but would get hold with two fingers or more, as it might chance.

By the last week of the month she played with as small an object as the curtain cord, especially the knot on the end of it.

I never at any time saw her make a snatch at an object within her reach and miss it, like Preyer's boy, by reaching too far to left or right, or too short. She sometimes reached for something a little too far away, but never from the first more than three feet away, and her accuracy in estimating her reach rapidly increased. Her method of seizing by a cautious extension of both hands, corraling the object, so to speak, between them, made it impossible to make many errors.

During the fifth month, the gesture of holding out her hands to be taken was developed from grasping; and also another interesting gesture, that of holding out the arms to an object rather as an expression of interest and desire than as a real effort to grasp it. In the case of these gestures, (both of which were first noticed in the nineteenth week), as they differentiated more and more from grasping, the arms were more and more reached toward objects at a considerable distance.

Through the sixth month the baby was eager to get at and touch everything; when carried about the room she put out her

hands continually, wishing to touch, pull, and carry to her mouth every object; she was no longer satisfied simply to watch. As she sat in our laps she was busy reaching in every direction for something to get hold of. If nothing presented itself within reach to seize, she would lean this way and that as if seeking something. Sitting on the floor she would at this time look around her for dropped playthings, and could pick them up if they lay conveniently. In carrying objects to her mouth she made no more errors: from the 153d day I noticed that she did it promptly and correctly. The same day a bright celluloid ball, perhaps two inches in diameter, was held out to her: she reached out both hands and took it between them and carried it to her lips, and this was several times repeated. I then held up to the light the large and heavy glass marble which she had managed successfully with both hands on the 141st day. Holding the celluloid ball in one hand, she reached for the marble, got it firmly in the other hand, and brought both at once to her mouth. This also was repeated several times. She had evidently quite got over any difficulty in managing different objects in her two hands. On the 158th day she tried to catch flies on the window, reaching her arms high after them as they crept up the pane. The 162d day she handled and bit a small rubber ring (such as is put about papers, — perhaps $\frac{3}{4}$ of an inch in diameter, the rubber about $\frac{1}{8}$ of an inch in thickness), and in the twenty-fourth week was devoted to strings as playthings.

One particular case of skill, which was remarkable as involving the use of a number of other muscles in co-operation with those of hands, arms, and neck, was the trick of putting the toe in the mouth, which began in the fifth month and reached great perfection in the sixth. The baby tried it first on the 148th day, and made great efforts, pulling the toes toward her mouth, but would always kick and lose them out. Then she took the toes of the left foot with the left hand, and clasped the right hand about the instep to hold the foot still, and so pulled it quite near to her mouth, but always lost it at the last moment. Finally she clasped the ankle and heel firmly with both hands, and so, after several attempts, brought the toe triumphantly into her mouth, — losing it instantly, apparently by diversion of attention, as she looked up to us for sympathy in her success. The performance was repeated at once,

however. After this, she managed it daily better, and was more interested in her toes: I was told that on the 155th day she caught sight of her feet when in her high-chair, and leaned over its tray and grasped them. By the 159th she got the toe into her mouth very skilfully, holding the foot with both hands firmly and getting the big toe between her jaws, where she would suck it assiduously for as long as her mother would let her (which was never over a minute). She would hold the toe firmly to her mouth with both hands all the time, and even when it was pulled or shaken out, would hold it "handy by." Her incessant occupation when undressed was now this sucking of her toe, varied with a few kicks and flourishes of her legs. The 167th day, the instant her skirts were drawn off, her legs went up as if a spring were released, and her hands went to her toes. At first her inability to keep the foot from kicking away from her as if it were a foreign object, unless forcibly held by her hands, showed very limited co-operation of the different parts of her body: but by this time (note of 168th day) she used legs and hands, head and mouth, very well together. After the 167th day, the interest in sucking the toe declined, though the baby continued for a couple of weeks or more to seize at her feet, which flew up the instant they were released in undressing; yet the movement was made as if by a mechanical habit, without much real attention to the feet.

I have said that even before the close of the fifth month objects were not grasped merely to be carried to the mouth, but "played with" a little, by moving them about in simple ways: this increased through the sixth and seventh months, and at seven months I saw the baby once or twice playing with something without trying to put it into her mouth at all. This was rare, however, even to the end of the eighth month: it was but slowly that the hand superseded the mouth as the chief seat of active touch, — far more slowly than it had taken the lead for purposes of prehension; and far on into the second year there were recurrences of the disposition to carry everything to the mouth. (See *Sense of Contact*, pp. 137, 138.)

In the seventh month there was perhaps not quite such an ardent absorp- tion. in seizing at anything and everything as in the

sixth, but I have incessant notes of the baby's reaching for objects that interested her. On the 202d day, I was told (but did not see it myself), she caught sight of a flower out of the corner of her eye, and reached backward and snatched it, without turning to bring it to the field of direct vision. It is not until the beginning of the eighth month that I find any note of the *swift* snatching by which babies elude the vigilance of their guardians, and get hold of things before they can be stopped: at this time she would thus snatch "like a shot" at the dog's hair if he came near, and pull it, — a considerably easier thing, of course, than to snatch thus swiftly, with correct aim, at a single small object.

By the end of the seventh month the baby's advance in locomotion was displacing her interest in grasping. The power was fairly acquired for life, and now took its normal place as one among her resources. It continued, however, throughout the first and second years, and to some extent even in the third, to be more used than it is by grown people: it was more necessary for the child than for us to *get hold of* an object instead of being satisfied with looking at it.

Her skill in grasping when the finger-tips alone could be used, perfected but slowly: in the thirty-fourth week she tried unsuccessfully to pick up tiny scraps and thrums, say $\frac{1}{4}$ inch in diameter, from the floor; in the thirty-sixth (249th day), she picked up a small tack and a pin with ease; and at thirty-eight weeks old she played with a single hair and with a wisp of thread scarcely larger than a pinhead. Even at fifteen months old, however, I saw her make several efforts before she could pick up a small shot.

Differentiation of the Forefinger Tip as Special Organ of Active Feeling.

I saw no sign of special delicacy of feeling in the finger tip till grasping had been thoroughly established for some months. On the 278th day (tenth month) I first saw the baby investigating some object with her forefinger tip; again the next day; and on the next the forefinger was much used, or sometimes the thumb and forefinger together. The next day the use of the right forefinger was very marked: it was often carried extended even when the baby was not

investigating, and when the other fingers were half closed; the left forefinger, however, was not kept separate from the others. Out of this special use of the right forefinger, pointing was developed, as I shall elsewhere describe.

Use of Right and Left Hand.

In the involuntary movements that preceded grasping I was not able to detect any predominance of either side of the body. Either hand closed equally well on an object laid in the palm, and in the various spontaneous and expressive movements of the early months there seemed no difference in activity between right and left limbs. The disposition to use both hands together was noticeable in all stages of progress toward grasping and for a time after grasping was acquired, — up to the middle of the fifth month at least. In fact, the early grasping may be in general described as two-handed, like a squirrel's; even when one hand did the actual grasping, it was after both hands had fumbled for the object, and whichever touched it first had the preference. When in the third month the baby was pulling herself up to a sitting position by holding to our forefingers, I never observed any difference between the hands in strength of pull. When in the fourth month, upon the hands encountering each other, each would seize and try to carry the other to the mouth, I never saw that either one exercised any predominance.

In several incidents where one hand or the other seemed to be preferred, it always proved to be due to mere accident, or to be contradicted by some other incident. The relative use of right and left hand in managing the foot, e. g., (p. 320) was entirely due to the position in which the mother always held the baby while undressing her, leaving the left leg freer, and exposed to fuller light than the right; when the position was reversed for experiment, the other leg was seized. In the sixth month, when the baby began to roll over (p. 333), it was always leftward, even when her toys were placed on the right, — indicating possibly that the muscles on the right were stronger; yet it may have simply chanced that the first time she rolled over was in this direction, and she had no idea of accomplishing the movement in any other way. After her mother had once helped her to roll over toward the right, she rolled one

way or the other indifferently. In the eighth month (228th day) she held a valise ten seconds with her left hand, and six seconds only and with more appearance of effort, with the right, — but the left hand was used first, and there was probably some general fatigue before the weight was taken with the right hand.

Nevertheless, we were satisfied that in the first weeks of grasping the left hand was more used; but I cannot establish this from my record. There is no question that after the two-handed period was fairly over, after grasping had become habitual, the right hand was the one used by preference, and has been consistently so ever since. When the use of the forefinger tip for special investigation appeared, in the tenth month, it was always the *right* forefinger; and so too in pointing afterward. It is my impression that it was at this time that distinct right-handedness became apparent; but my notes do not make this clear.

In climbing upstairs in the twenty-first month the right foot always led, — probably in all the climbing, but I failed to observe as to this. In first using a fork at table (fifteenth month) and later in all implement-using, and in giving her hand, the child always used the right hand as a matter of course, without instruction. In many cases where I have not recorded which hand was used, or which foot led, I am satisfied I should have noted it had it been the left, since the use of the right was after the age of eight or nine months so common and apparently so instinctive with her; and since I myself am strongly right-handed. The child's parents are both right-handed, the mother strongly so; the father's mother and brother have a decided ambidexterity, which seems to remain from an original left-handedness, out of which they have been trained; and an uncle of the mother's is completely left-handed.

EQUILIBRIUM AND LOCOMOTION.

The main movements by which the powers of balancing and carrying the body in human fashion were acquired (holding up and turning the head, sitting, rolling, creeping, standing, walking, running, climbing, jumping) I have not separated into topical chapters, since a better idea of the progressive development of command over the body can be had from a continuous narrative. The movements unfolded to some extent one from another, in a continuous progress.

First Two Months: Holding up and Turning the Head, and Progress toward Sitting.

From quite early, perhaps even from the first week, (I began to notice it in the second) there was perceptible in the bath a tenser or more innervated condition of the muscles, and especially of the neck muscles; by the third week there was an appearance of voluntary effort in this stiffening of the neck, and when the baby's body was held horizontally in the water, her head supported just over the surface by her mother's fingers, she would raise it slightly from the support. The ability thus to raise the head increased steadily without any marked step of progress. Meanwhile the vague spontaneous rolling of the head to and fro took on more appearance of real turning in order to stare about; in the fourth week (25th day) the head was unmistakably thrown backward in order to see something better (see Fixation, p. 14).

In the fifth week blind seeking movements with the head were made when the baby was placed at the breast; there was a trick of turning the head sidewise in looking at the mother; once (32d day) when the baby was laid on her face, she turned her head sidewise to free the face, at the same time propping her body up somewhat with her knees; on the 33d day the head was unmistakably turned to follow the movement of a candle.

By the end of the fifth week the head was held up from the mother's hand in the bath for twenty seconds at a time, at an angle of about forty-five degrees with the line of the back. At the same

time the body was strongly propped with the knees on the bottom of the tub. It was no longer in the bath only that the head was raised: the baby would lift it to see around, sometimes for twenty seconds at a time, when she was held upright against the shoulder. By the end of the sixth week, when held thus against the shoulder, or upright in the arms, she would hold her head erect, balancing it perfectly for perhaps a quarter minute, and even then would not drop it limply, but seek some neighboring support to rest it against.

In the seventh week she could hold her head up in the bath fairly at right angles with the line of her back, for a quarter minute or more. She would rest it sidewise on her mother's wrist when tired, then raise it again. While holding it up, she would keep it turning from side to side all the time, — a movement which I have classed as spontaneous, (p. 300) but which I mention again here, since the power to balance and turn the head at the same time was now first seen.

One day in this week (45th day) the baby turned her head to look at the piano keys, — the first unmistakable use of the movement to bring something within the field of vision.

Meanwhile a pleasure in having the body also erect had become apparent. The baby's liking for upright positions — for a sitting one in which her grandmother held her, and for the position up against some one's shoulder — had been noted as early as the sixth week, and in the seventh (47th day) I noticed that when fretting persistently she stopped when I lifted her to my shoulder. This liking now began to develop into desire: in the ninth week the baby would usually begin to fret after lying down some twenty minutes, and would seem satisfied when lifted and held against the shoulder. On the 57th day, when thus held, she would first raise her head erect, then straighten back against the arm that supported her till her back also was erect, (propped by the arm or hand behind to be sure, but still taking much of its own weight,) and would then occupy herself in looking about. This she did persistently every time she was taken up. As often as pressed down on the shoulder she would become discontented and straighten herself up again. She would hold the head erect for a half minute, then

lean it against my cheek for a few seconds, raise it again, drop it forward on her breast, hold it up, drop it backward,—not helplessly, but as if to look at the ceiling,—and again raise it,¹ always in high content till made to lie down.

Here was a distinct step toward sitting, in the desire and ability to hold the spine as well as the head erect; and it continued daily,—the power to balance the head slowly increasing at the same time. On the 59th day the head was held up (when I timed it once) two and a quarter minutes; it wavered a little during this time, sinking somewhat forward or to one side, but most of the time was quite erect. The 60th day it was held up with some wavering, but without once sinking to any support, for many minutes. By the second week of the third month the head was balanced quite perfectly, and turned at will to look about.²

Third Month to End of the Half Year: Sitting, Turning Over, and Primitive Leg and Trunk Movements.

The desire for the sitting position now, with the beginning of the third month, became most persistent and striking. The baby for a time made no effort to raise herself, but would fret and sometimes cry hard till she was raised and held in a sitting position. Her back was always supported carefully, but once when an inexperienced person neglected this precaution for a minute, steadying her only, she held herself up firmly, and seemed to like it. By the twelfth week her insistence had led to her spending much of

¹ It was at this time that the curious jerking and turning movements referred to above (p. 301) occurred. On the 56th day, while thus holding her head erect, the baby began to jerk it to left and right as far as the neck would turn, so strongly that when I did not keep my face out of the way I received a really smart blow. She would let her head drop on my shoulder for about two seconds, then raise it and jerk it about again; this she kept up for five or ten minutes. The 59th day, while holding up her head with persistent effort, she turned it continuously from side to side for about a minute, this time without the jerking motion, and with some appearance of deliberate experiment,—quite a different movement in manner from the semi-spontaneous turning to and fro in the bath, above referred to (p. 326).

² Of the vigorous and skilful movements of the neck in the fourth, fifth and sixth months, in connection with grasping, I have given a record above.

her time propped up with cushions, and in our laps she was always held sitting.

As far back as the seventh week, when the mother held her hands in wiping her after the bath, and perhaps gave a slight unintentional pull, the baby had begun to pull, as if to lift herself, though she probably had no such intent at that time (p. 312): her mother had tried to develop this, however, giving the baby her fingers and starting her by a suggestive little tug; and she had doubtless had the experience more than once of finding herself raised a little in this way. She now, in the twelfth week, certainly made efforts to raise herself, pulling with energy on her mother's forefingers when one was laid in each hand. She tried also to lift her body directly by the abdominal muscles, raising her head and shoulders from the lap or lounge but getting no further up.

A few days before the close of the month (89th day) her parents called me, saying that the baby had raised herself to a sitting position. She was lying slightly reclined along her mother's knees, between which her hips were somewhat braced, giving her an advantage in lifting herself. While I looked, she raised her head and shoulders, then her body, with much appearance of effort, till she was sitting. She did this twice, and tried a third time, but was evidently tired, and failed. She did it calmly and seriously, without any sign of pleasure or pride in the exertion, evidently for the mere purpose of getting into a sitting position. The next day her mother laid her along her lap again to see if she would repeat the action, but the hips were not so well braced, and though the baby tried to lift herself she did not succeed. Later, as she lay across her mother's lap, she kept trying to lift herself, raising head and shoulders, till I took her hands to give her a leverage: she tugged at my hands with such zeal that her face grew red, and raised her head and back, but the legs also rose, overweighted by the trunk, and she could not raise the hips and buttocks; she fell back, but immediately tried again very earnestly, and still a third time; then she became discouraged, and began to fret pitifully, on which her mother interfered and lifted her up. Once again before night, as she lay reclined a little on a pillow, she raised herself several times till her shoulders and her back as far as the lumbar region were clear.

After this followed several days of persistent efforts to raise herself. On the last day of the third month I found the baby lying in a somewhat reclining position and trying from time to time to sit up: I gave her my forefingers to pull on, and finally, with great effort and eagerness, she pulled herself fairly up, and immediately tipped over sidewise. Afterward she tried twenty-five times, with scarcely a pause between, to lift herself by the abdominal muscles, but could lift her head and shoulders only; she showed discouragement by this time, but might have gone on trying had she been allowed. I was told that earlier in the day, when somewhat higher on her pillow, she had thus, by the sheer pull of the abdominal muscles, brought herself up sitting, and at once tipped forward on her nose. The effort and earnestness of all these attempts to sit up was astonishing; and when the baby pulled on my hands the strength of her grasp and pull was something most unexpected, — fully equal in proportion to her weight to that of any grown person.

With the fourth month the progress in sitting seemed checked. The baby had possibly become tired or discouraged by her futile efforts to raise herself. During the month she would occasionally try to lift herself, either by the abdominal muscles unaided, or by pulling on our fingers; and by the latter method could raise herself half-way, but never quite erect. At just sixteen weeks old, when propped in a lounge corner almost erect, she raised herself completely, and sat for ten minutes or more with apparent ease and perfect balance; but I found that the cushions and lounge back made a support for her hips. Twice, however, (once in the fifteenth week and once in the seventeenth,) she sat for a few seconds in some one's lap quite unsupported and unsteadied.

During the early part of this month, her determination to be always sitting or else held upright was as strong as in the third, and nothing but having her legs free to kick could reconcile her to being laid down when indoors; but by the middle of the month, sitting being now customary, she did not object to being laid down for a few minutes at a time; in the fifteenth week, when laid on the floor face downward, she would enjoy the novel position for a short time, being now able to raise her head and shoulders and look around. Up to the seventeenth week, she was content

to lie down in her baby-carriage outdoors; but in that week she rebelled, and fretted till allowed to sit up. The first time that this happened she shortly became very sleepy, but though her head drooped forlornly she would not be laid down, protesting whenever I tried it, half-asleep as she was.

At four months old, in deference to an old frontier custom urged by the grandfather, the baby was seated daily, with her playthings, in a horse-collar: it proved a comfortable seat, affording just the support for her hips that enabled her to sit erect, and she would sit very quietly for twenty minutes at a time, looking about and putting her rattle or spools into her mouth. Her experiments in the nineteenth and twentieth weeks at bending her body back over this horse-collar, and afterward over the arm of any one who held her, have been noted above (pp. 143, 198). By this time she required but the slightest steadying to sit erect, and often sat on our laps for a few minutes without real support, though steadied by a hand. In the nineteenth week, she was delighted by being seated astride one's foot, held by her hands, and swung up and down with the foot. She was at this period coaxed through the first stages of drowsiness by being seated on the point of the knee and trotted, as noted under Sleep. The strength of her back was evidently quite adequate to sitting alone, but the balancing was not mastered.

(In this week, the nineteenth, began the progress toward locomotion, in the first rolling and sprawling movements on the floor: the development of these now went on alongside that of sitting, and will be reverted to presently.)

On the 139th day she sat quite alone on my lap for some ten seconds; the next day several times for a full minute: she could sit alone very well when perfectly still, but if she turned about, reached for anything, or even flourished her hands or feet, she would topple over. When seated in her baby-carriage two days later, she began to play with the leather strap that passed in front to prevent her falling out, and sat erect for nearly half an hour without other support than the contact of her hands (and sometimes her mouth) with this. Sitting quite alone for a minute or two now became common, — or for longer periods with but the slightest pretext of support; once, on the 143d day, losing her balance, she recov-

ered it instead of tipping over. This sitting alone, however, was always thus far on the lap or a cushion, or some other hollowed or yielding surface: she could not keep her balance on the floor or table for more than a few seconds.

The sixth month showed gradual improvement in equilibrium in sitting, with no marked step of advance. At twenty-two weeks old she could not sit alone on the floor more than half a minute, — she could hold herself erect without difficulty, but could not keep equilibrium, and would topple as soon as she reached for anything, though she was now quite secure in her balance for several minutes on the lap. At twenty-five weeks, she sat pretty steadily on a stool for a good many seconds, not even toppling over when she sneezed. On the last day of the month (twenty-sixth week) she sat for nine minutes on the lap, and six minutes on the floor, and in neither case showed any insecurity at the end of the time, but became restless. When not kept perpendicular by judiciously dangled playthings, however, she still was sure to tilt herself over before long by reaching after something, or by throwing up her feet to catch at her toes. On the lap she often sat for long times without any help. From high reclining positions — perhaps half sitting — she could sit up with ease; but during the whole of this and the preceding month (except for a slight renewal at twenty weeks old) efforts to raise herself when lying down had been given up.

This may have been partly because lying down became more agreeable now that she could move about more freely. I have mentioned above that in the nineteenth week the first locomotor movements had appeared. At that time the baby had begun rather suddenly to turn and change her position a good deal when lying on the floor, — not to roll completely over, but to get from back to side, and by sundry slight, irregular movements to get into quite varied positions. What with this rudimentary rolling and wriggling on the floor, the freer turning, leaning, bending, and recovering in sitting, and the movements connected with grasping, especially the complicated ones in reaching for and handling her feet, it is evident that by the latter part of the fifth month, the trunk and limbs were coming into a condition of control and flexibility favorable to the later achievement of creeping, standing, and walking. The *desire*

of locomotion had also to be developed considerably before the baby would put herself to the necessary effort of acquiring it; just as a great desire to sit up was necessary before the effortless position of lying down could be abandoned for the difficult balancing and muscular exertions of sitting. The first rudiment of desire of locomotion appeared in the twentieth week, and in connection with grasping: on the 136th day, as the baby sat on the table, she began to lean forward on my arm, which encircled her, till I let her sink down on her hands and knees; and in this position she tried quite hard to strain or scramble forward to reach some desired object, pushing backward with her feet, but did not actually move forward. She had had incidentally a good deal of experience of being moved forward by pushing with her feet (in the bath-tub, *e. g.*), and this movement may have been the result of that experience, or may have been merely an accompanying movement, in the effort to strain forward.

During the first half of the sixth month the sprawling about had increased in freedom, and was enjoyed for fifteen or twenty minutes at a time by the baby; but showed no tendency to develop into any regular method of locomotion. From the fifteenth week, the grandmother (believing creeping an important preparation for walking, better for limbs and back than any of the substitutes, such as hitching) had placed the baby on the floor, face downward, to give her an opportunity to develop creeping movements; but without result. In the twenty-second week she had begun to set the baby on arms and knees on the large dining-table, bracing her with a hand against her feet: the baby, as usual on feeling her soles set against anything, would push backward, thus thrusting herself forward; and as the table-cover slid on the smooth surface, and the hand behind her feet was advanced with her, she would thus struggle rapidly across the table, grunting toward the end of the trip with an air of much exertion. Her grandmother purposed thus to encourage the idea of forward progression, and associate it with the creeping position. The effect, however, seems to have been to strengthen the association, already probably incipient, between forward motion and the act of pushing backward with the feet: for on the 167th day, and again on the 168th, when the baby was lying on her stomach, and saw something before her that she

wished to get, she began pushing with her feet against empty space, fretting when she found this futile. Once in struggling toward it, she approximated creeping movements, but her feet and knees were so entangled in her long skirts that she accomplished nothing. A considerable advance in rolling which took place this same week (twenty-fourth) now diverted her from the disposition to creep, so that though she was put into short clothes the next week, no more efforts at forward movement appeared for some time.¹

This advance in rolling seems to have come about accidentally: the baby, in trying to reach something, rolled over entirely, from back to stomach. I saw this first on the 167th day, but was told it had happened several times in the preceding days. By the 168th day she was rolling over purposely, and sometimes quickly, though at first it had been done slowly. At first, too, she had always caught her arm under her when she turned, and extricated it afterward with difficulty; now she drew the arm out easily. The next day, the 169th (just twenty-four weeks old), and for days following she rolled over whenever she was laid on her back, sometimes quickly, sometimes with difficulty; and lying on her stomach, would lift her head and shoulders and look round, like a little lizard. She always tired soon of the position, however, and being

¹There can be no doubt that the early locomotor movements are unduly delayed by the baby's skirts, and that a baby would profit in development and use of limbs by much nude exercise. After creeping is learned, babies are often put into "creepers" (garments of rude trouser form, devised for freedom of movement and protection from dirt); but in the stage of development that *precedes* creeping, when a great number of approximate movements are being made, out of which the useful locomotor ones will later be selected, the legs are usually much confined. The appearance of these preliminary movements should be a signal for giving the baby all practicable freedom of action. Babies who are kept always on a bed or in the lap are put at a great disadvantage in this respect; and even in the case of my niece, who was a "floor baby," the first disposition to creep may have been lost by a week's delay in getting her into short skirts. The mother must avoid the danger of cold, even at cost of checking muscular development: but it seems a reasonable conjecture that without the hampering influence of long skirts and the practice of keeping babies off the floor, this primitive quadrupedal movement would appear much earlier, and play a larger part in the infant's activities, than it does. If it preceded securely balanced sitting (as my observations indicate that, without any artificial check, it might), the less natural and less useful hitching would never appear as a substitute.

unable to turn herself back, would begin to fret. Nevertheless, she took great satisfaction in the enlarged freedom of her movements,—which, as I have suggested above, may have been the cause of the cessation, for the time, of efforts to sit up.

It will be seen that at the close of the first half year the baby was fairly well able to sit alone (though with still insecure equilibrium); and that the activity of trunk and limbs was considerable, and the tendency toward rolling and creeping movements clearly visible. At this stage of development Preyer's child made regular walking movements when held with his soles touching a flat surface and moved gently forward; and Champney's child made these alternate movements very perfectly as early as the nineteenth week. In my niece's case, there was no sign of any instinct to walk.

Of primitive movements that might have some relation to walking, the earliest were the propping with the knees (p. 325), and the pushing with the feet against a resisting surface (pp. 180, 189) repeatedly mentioned above. In the seventh week this pushing against the foot of the tub was so strong that the mother could not keep the baby from bumping her head against the other end of the tub. In the twelfth week, when I seated her on my arm, holding her encircled with my other arm, and jumped her a little, she pushed strongly on my knee with her feet. Her grandmother at this time used to seat her on her palm and jump her, letting her "feel her feet" in the same way, and she was fond of the exercise. In the twelfth week began the strong and straight kicking described above (pp. 188-9), showing increased power over the movements of the legs. In the fifth month the baby made springing movements with her body, while sitting in one's lap or arms. Usually these appeared to be expressions of joy and interest, but on days when they were very persistent they continued through every mood; as on the 153d day, when the baby was in a fretful condition, crying hard unless constantly diverted, yet kept springing in my arms as I carried her, or on the table when I set her down on it. It did not seem to be in such cases an expression of restlessness, but rather a persistent and unaccountable impulse, independent of her mood. With the sixth month she began to spring, instead of merely pushing, when held erect with her soles touching any

surface (even when taken into the lap): she would push down with her feet, and spring so strongly that it was hard to hold her. In the latter part of the sixth month the springing sometimes indicated desire for a frolic: at the same time, it ceased to be invariable when the baby was held with soles touching, — the old pushing, or an aimless kicking and shoving (with toes turned in), taking its place. In the bath (twenty-fifth week) the baby would plant her feet against the bottom of the tub as she was put in, before she could be seated, and would thrust with her feet till she lifted herself almost to a standing position; she could with difficulty be made to sit down. There was no appearance in this of desire to stand; it seemed merely an impulse to *push*.

Outside of this pushing, kicking, and springing, and a little propping of the body with the knees, there was in the first half year no disposition to use the legs in any way.

Seventh and Eighth Months: Secure Sitting; Raising Self to Sitting Position; Rolling, and First Creeping Movements; Beginning of Standing.

With the beginning of the second half year the baby's equilibrium in sitting rapidly grew secure: by the middle of the seventh month I have record of her reaching in every direction as she sat, without losing balance, and by the end of the month she would sit alone by the half hour. Yet for several months longer she was not absolutely secure against an occasional unexpected and apparently causeless over-tilting, — perhaps once or twice a month. In the latter part of the seventh month she made a few efforts again to raise herself directly from her back; and once or twice pulled herself up by some neighboring object.

At the beginning of the month, a little tendency toward creeping again appeared, through changes of position and movement when she had turned over face downward and propped herself with her knees; but it was again checked by an advance in rolling, — the discovery that she could roll over from her stomach to her back. This ability made her happy in rolling and kicking by the hour, changing her position at will. She made no effort to progress by rolling, but if she happened to turn over in the same

direction a number of times successively, she would traverse half the width of the room, coming in contact with many articles of great interest to her. Sometimes she would roll over to reach something, sometimes merely for change of position. Once (at twenty-nine weeks old) chancing to roll under a chair, she laid hold of it, and worked and drew herself under it, — doubtless by mere purposeless pulling. Her delight in the enlarged freedom of movement not only, as I have just said, stopped entirely the progress toward creeping, but considerably suspended the great pleasure she had taken the month before in grasping.

In the first week of the eighth month (217th day) the baby waked and cried some time before she was heard; and when her mother went to her, she found her sitting up in bed: whether she had pulled herself up by the bedclothes or lifted herself from the pillow we could not tell. In the thirty-third week, I saw her raise herself from a pillow; and in the same week, she would raise herself easily by my fingers (if started by a little suggestive pull), scarcely bringing any perceptible weight on them. Just at the end of the month, sitting in a large chair, her face toward its back, she chanced to thrust her feet through an opening between its seat and back, and her feet being thus held, she began to lie back and sit up with perfect ease. This was repeated on the next day.¹ For about a week, however, as she played about the floor, she had had a more practical method of sitting up than either pulling up by some article or directly lifting herself by the abdominal muscles: this was to rise not from her back but from her side, leaning on one elbow and hand.

In the latter part of the month she would sit in a rocking-chair and jiggle it, without disturbance to her equilibrium. Her sitting of course, even in a chair, was not the customary adult position, with knees bent, but the primitive one, with legs extended before

¹From the ease with which she sat up it was evident that the abdominal muscles had long been able to raise the trunk, and the only difficulty had come from inability to keep the legs down and give the lifting muscles leverage. Even grown people, in raising themselves by the abdominal muscles, are obliged to overcome the superior weight of the trunk as compared to the legs; and a baby's legs are much lighter, proportionally to the trunk, than an adult's.

her. She had sat on the lap or on an arm, however, with knees bent; and she took up this artificial civilized position with great ease, — though it is likely that for some years the primitive one was somewhat easier.

Her rolling was still aimless, but more and more free and quick. On the day she was thirty-three weeks old I find mention of her "whirling" away, when her mother went to take her up from the table, where she had been laid down and allowed to roll; and on the next day of her "singularly rapid" rolling. She would now roll over and over several times in rapid succession, apparently for fun, without any appearance of effort, keeping her arms skilfully out of the way. Her joy in it was remarkable: during much of the month there was nothing she so desired as to be put down on the floor and allowed to roll, kick, and twist about freely. Outdoors she would coax to be put down instead of being carried about. I have not noted and do not remember that she ever wearied of it: the end of her hours of rolling about would be set by the needs of feeding or otherwise attending to her, not by her own fatigue.

When lying on the floor, she would twist her body about very skilfully to reach things; and once (234th day), when she had rolled partly under a chair, she took hold of it and pulled it above her and played with it, greatly pleased with the performance.

Up to the middle of the month I still saw no tendency toward creeping: she was more than content with the rolling. At thirty-two weeks old I twice saw her rest on her hands and knees and make two or three creeping movements, then sag down and roll over. Watching closely for the next few days, I saw that when rolling and twisting on the floor, she now and then raised herself on her hands and knees, but had no idea of locomotion. If I put my hand under her, she was disposed to lift her knees, and rest on her hands and feet instead.

Throughout the thirty-third and thirty-fourth weeks, it was my daily note that she would several times a day get to her hands and knees, now and then even taking a step or two with them as if by accident: the movement, being one to which the position and

the structure of the limbs were well adapted, was one quite possible to make almost accidentally. One day in the thirty-third week (229th day) she drew herself forward flat on her stomach a few inches to reach something, — the first real voluntary locomotion. In the thirty-fourth week these positions were taken with more ease daily, and began to vary the rolling about. At last, on the day she was eight months old, the baby half crept, half sprawled forward a few inches to get something.

During the same fortnight, she had been learning to pull herself to her feet and stand by a support. For about six weeks in the second half year there had been absolutely no progress toward standing or walking (except that an increasing vigor of back and legs was shown at the end of the seventh month, when the mother first let her sit in the bath without a steadying hand: she sat carefully, but celebrated her freedom by beginning at once to splash with her arms in high glee; and as soon as her mother, afraid she would upset herself, put a steadying hand in the lightest way behind her head, the baby would begin to stiffen and throw her body, resting on her feet and her mother's hand). But at thirty-two weeks old, the day that I first saw creeping movements, I noted that the baby was pulling herself to her knees in the bath, holding by the side of the tub; sometimes even partly to her feet, supported by the water. At thirty-four weeks old, she began to pull herself quite to her feet, and afterward did this daily. She would hold by the edge of the tub, leaning far forward, her feet planted wide apart on the opposite side of the tub (an ordinary wooden wash-tub, her own little tin bath having been outgrown); on the last day of the month, she brought her feet nearer together.

Her expression of pleasure in this achievement was noticeable; and indeed the whole process of learning to stand was more conscious than creeping, which seemed to have been almost stumbled upon in the first place, and afterward used merely to help to the attainment of desires; while the impulse to pull up to knees and feet seemed to come on her in a curiously instinctive and compelling way, and to give joy in the satisfying of an internal necessity.

In the thirty-fourth week, after she had been pulling to her knees, and nearly to her feet, for a week or more, her grandmother

advised letting her practice pulling up by our hands: she would sit in our laps, bracing her feet against our bodies, and when started by a slight pull would draw herself up till she was poised on her feet, when we would at once bring her forward to rest on the breast, that she might not bear her weight on her feet for more than a point of time. She enjoyed this greatly, and seemed strong and perfectly able to do it; but in a day or two, having a cold, she seemed less able, and her knees would bend; so it was given up.

It was at this time that when taken under the arms and swung out, she would lift her body and legs and straighten them by sheer muscle, till she was horizontal or more (p. 191), keep the position a second or two, then relax and repeat it, — showing a considerable strength of back. At the same period, she would fairly fling herself (from a chair, e. g.,) toward any person by whom she wished to be taken.

**Ninth Month: Raising Self to Sitting Position; Progress in
Creeping; Varied Scrambling about; Progress
in Standing; First Walking Movements.**

With the ninth month began a period of rapid and varied development in movements, difficult to narrate in clear order.

On the first day of the month I took careful note of the baby's method of sitting up. When laid on her back she would soon roll over; then raise herself to hands and knees; then lean sidewise till she was in a sort of inclined sitting position, resting on one hand; then lift herself up sitting, — all quite easily and unconsciously. The next day I saw it done in the same way, but also by another method, which soon became the regular one: the baby would first rise to hands and knees, then separate the knees and *lift herself backward*, — a process that has been found practically impossible by adults who have tried it for me. It brought the baby to an unusual sitting position, with legs spread wide before her, turning out at each knee in a right angle. I had watched for the simian position in sitting, so common with babies, — legs extended before them and soles turned toward each other, — but I never saw it; instead,

the one just described, with the outward turn at the knee, became the invariable one.¹

Watching her a long time, her grandmother and I were both convinced that the sitting up was not a voluntarily adaptive movement, — that the baby did not know whether she was going to bring up sitting or not, but tumbled and scrambled around, and found herself in these positions. Apparently she desired to sit up, but had no clear idea of the movements necessary, and experimented till she found herself sitting, scolding all the time. This seemed true to me for several days, but the movements daily became more definite and purposive. The attempt to lift herself directly from her back by main strength was entirely given up.

She would now sit on the arm of a stuffed chair, her feet in the seat, with entire security of balance; in the thirty-eighth week she enjoyed sitting on the edge of a hammock and dangling her legs.

Rolling declined as the baby became able to sit up and lie down at will, and to occupy herself with the more varied movements about to be described; it was never common after the first week of this month.

The scrambling about the floor, however, became more varied and interesting. On the first day of the month, among sundry indefinite movements, several steps of "crawfishing" were taken, — a sort of retrograde creeping, pushing backward with the hands. Apparently there was no intention of getting anywhere by this, only a disposition to movement. On the second day the baby backed away from me when she wished to come to me, scolding with disappointment all the time. At other times she would back into the wall, to her own displeasure, and scold vigorously, all the time pushing back against the obstacle like a little engine unable to reverse itself. These incidents seemed as if there was now some desire of locomotion, but an entire inability to guide or adapt her movements. The superior strength and importance of the arms as compared to the legs was evident: the disposition to use a simple

¹The position was puzzling to me, but Dr. Le Conte explains it as due to an extreme freedom of movement in the hip-joint, not impossible in an adult, though doubtless unusual. Even at seven years old, the child shows a certain tendency to turn the leg outward at the knee in sitting flat on the floor.

pushing movement with the arms probably gave the backward motion, and the legs did little more than yield to this. In a day or two the baby's action in this "crawfishing" became quite free, and she would move some distance, "half creeping, half wriggling" (thirty-sixth week). In this week she would occasionally take a forward step or two on hands and knees, but with no idea of locomotion. In the thirty-seventh week, when sitting, instead of getting on hands and knees to creep to an object she desired, she would throw herself prone, stretch her arm to it, and sit up again.

Late in the week, however, on the 258th day, real creeping began. She several times crept a foot or two forward, and once I saw her rolling an orange about the floor and creeping after it. I then placed her playthings before her, some four feet away. She looked earnestly at them, but made no effort to reach them till I drew them to within two feet; then she crept three or four steps, then dropped prone and stretched her arm till she managed to get hold of one. Later in the day I called her to come to me, holding my arms and coaxing: she crept about a foot and a half, using her hands well but her knees awkwardly and far apart; then gave up and sat back on her heels, calling to me to take her, and would not move on for any coaxing; but when I leaned forward and shortened the distance, she took courage, and crept on till she could grasp my hand. She now seemed to understand that she could get somewhere by creeping, and daily improved in it: "creeps several feet easily," I note the next day; the next, she twice crept half way across the room to a door, hearing her grandfather's voice on the other side; but for many weeks she would creep only short distances, and always for an object of desire, not for the pleasure of the movement.

From the first of the month, she would sometimes rise from hands and knees to hands and feet, and then would strain upward, as if trying to rise to her feet. Meanwhile, pulling to the feet by some hold above her had increased: she would climb up to get at her mother's face and ear, while undressed in her lap; when held up a little in my lap she pulled to her feet and stood resting her weight partly on them, partly on her hands on my shoulders, much as she was in the habit of standing in the bath-tub;

held against her mother's shoulder, she would pull back, and try to stand in her lap; in the bath her one idea, as soon as she was placed in the tub, was to pull herself to her feet. On the 246th day she drew herself up by her mother's dress, with much wabbling of the knees. Later the same day she could not get to her feet in the bath when impeded by a sponge in her hand, but tried persistently till her mother took the sponge away, when she succeeded; afterward she held to the edge of the bath with one hand and reached with the other for the sponge, keeping her feet; but twice at other times she fell, receiving a slight bump with unconcern. In the thirty-sixth week her skill in pulling up and balancing was visibly improved; once she drew herself up by the edge of a basket into which she was set, and once by a box in which her playthings were kept, leaning over it (about a foot high) and holding with one hand, while she extracted what she wanted with the other. In all these cases, except the one instance of getting up by her mother's dress, she used an object lower than her standing height, (*lifting* her body, rather than pulling up by her arms,) and so did not stand erect, but leaning over, resting much of her weight on her hands; and this, with the wide planting of her feet, made balancing easy. Unlike sitting and creeping, this standing was quite consciously achieved, and the baby showed triumph and joy every time she succeeded in getting on her feet.

She was now, in the middle of the ninth month, capable of a medley of movements that gave her singular joy. She would tumble about the floor or lawn, sitting up and lying down, raising herself to her knees and thence sitting back, raising herself to hands and knees, then to hands and feet, then settling down again to hands and knees; twice I saw her (257th day) raise herself to her feet and hands, and then raise one hand into the air and hold it so for some seconds, — a position very suggestive of rising directly to her feet. She would raise herself from hands and feet to her knees, or to one knee and one foot; she would sit on her heels; or on one heel, the other leg stretched out sidewise, so that she propped herself with the foot. Once or twice when she was supported on hands and feet, raising her body as high as possible, she held her head very low, almost touching the carpet. I thought for some days that in creeping she used one foot and

one knee; but when I had an opportunity to see her motions without any skirts (260th day) I noted that the leg movements were correct in creeping, except when now and then, after she had just been kneeling on one foot and one knee, she would drop down and begin to creep, in which case she would for a step or two use one knee only, dragging the other leg. Her kneeling did not seem to me quite regular; the legs seemed doubled up and awkward, but I could not make out just how: she could not keep the position many seconds, but would take it every few minutes, as she sprawled, rolled, crept, and sat about the floor; and she appeared to enjoy getting up to her knees as a daring achievement, and would pat and wave her hands exultantly as she balanced thus. When creeping she would often stop and sit back, bringing herself to the sitting position described above.

In spite of her joy in her movements, I was constantly impressed by the lack of *adaptiveness* and intelligence in them, even while to the observer they were plainly working slowly toward our own well-adapted means of locomotion. One day in the thirty-seventh week, for instance, (255th day) she had backed herself partly under a lounge, and there tried to rise from hands and knees to hands and feet: the lounge prevented, and she was disappointed at her failure, and tried over and over to rise, but had not sense enough to move forward clear of the obstacle; nor did it occur to her to look back and see what held her down.¹ There was so little skill of movement, too, that as late as the last day of the thirty-eighth week, she slipped in creeping, and fell on her face, hurting her lip.

Thus far (thirty-seventh week) standing did not enter much into the medley of movements, as the baby had not yet begun to get to her feet except by the help of a few specially favorable

¹ Yet she had looked to see what touched the back of her head as early as the fifth month (p. 143); and the last day of the eighth month (242d) she had showed a good deal of adaptiveness. She had chanced to roll under her crib, and to roll and sprawl out on the other side, where she sat up, with some help from the edge of the crib, dropping a plaything in the effort; it rolled under the crib and the baby tried to lean forward and get it, and bumped her forehead; she drew back, then repeated the effort, but after several raps, at last bent her head over to one side almost to her lap, and then leaned under and reached the article, and drew back in the same way, keeping her head carefully lowered till it was clear of the crib. This was unusual cleverness, however.

objects; but the desire to stand and skill in standing grew steadily, and on the last day of this week she twice drew herself to her feet by a chair, her knees shaking, to reach a favorite stuffed toy cat that stood on it; and after this, pulling up by chairs increased. In the thirty-eighth week, as she played about the lawn while we sat by with books or work, she interspersed her varied scrambling about with visits to us, to pull to her feet by chair or knee. What with the new freedom of movement, and the many objects of interest on the lawn, and the usual diffused joy in outdoors, her happiness at such times was indescribable. The joyous expansion of powers experienced by a baby who in one month has achieved the power of creeping, standing, and various minor movements, is something we can but dimly imagine from the exhilaration of acquiring a single new power of balance and motion, as in wheeling or swimming. The change in this baby's own consciousness within three weeks must have been enormous.

On the 267th day, the last of the thirty-eighth week, some one looked up from dinner to see the baby standing by a lounge, merely steadied by one hand pressed against it, while she waved the other with joy and pride. Her father sprang and caught her as she went down; then set her on her feet, within the circle of his arms but without support, for a few seconds: her legs shook, but she stood without fear and with evident exhilaration.

This month at last (in the thirty-sixth week) appeared walking movements when the baby was supported from above, with her soles lightly touching, — awkward and merely approximate movements at first, but fairly good in the thirty-seventh week. They continued whenever the opportunity was given, and afforded the child great pleasure.

Tenth Month: Rapid and Free Creeping; Standing Alone; Stepping by a Support; Beginning of Climbing.

The last two days of the ninth month, and for three days in the tenth, I was absent from home: and when I returned, I found the baby creeping rapidly and easily, and pulling to her feet persistently

by chairs. The varied scrambling about had disappeared, a survival of the fittest having taken place in favor of creeping and standing. She laughed with pleasure as she crept; and her desire to stand was incessant and absorbing. Her toys were neglected; she was impatient of being held in arms, so eager was she to get to the floor and exercise her new powers. When laid on a blanket on veranda or lawn, she would at once start rapidly off creeping across tiles or grass, stopping to investigate plants, dead leaves, or gravel.

She was clever and bold in getting to her feet, and would hold with only one hand, even leaning down sidewise to pick up something, without losing balance. On the 278th day she climbed to her feet by a window-sill while holding a spool in each hand; and by the end of the week (the fortieth) it was common enough for her to pull herself to her feet while her hands were occupied with some object. She would creep, also, with her hands occupied, or while gesturing with one hand.

When standing by a chair she would let go, — in the effort to stand alone, I thought at first; but by the second day after my return I made up my mind that it was done for the fun of falling: she would pull to her feet, laughing; then deliberately let go and come down sitting with a thud, and look up laughing and triumphant. This amusing performance was kept up for several days. The sitting down was apparently in her mind as much a part of the exploit as the getting up, and the force with which she came down did not seem to frighten her in the least (see p. 205).

On the 279th day, for the first time, (except in the one instance when her father set her on her feet,) she repeatedly stood quite alone for several seconds. This she did not by letting go her hold when already standing, but by raising herself to her feet with the help of a low body (her uncle's leg as he sat flat on the lawn, e. g.) and then, instead of remaining in a stooping position, as she had always done before when she had risen to her feet with the help of a low support, she straightened up, abandoning her support, and stood quite alone, showing great pleasure in the ability. In the next two or three days, by the beginning of the forty-first week, she proved able to stand a minute at a time when set in a corner, back to the wall, so that the pressure of her shoulders against the

wall steadied her; while she could stand for many seconds with but the slightest hold, — as the fold of a gown in her hand, — and for three or four seconds quite alone.

In the forty-first week, she no longer let go her hold of a support on purpose to feel herself drop, but lowered herself carefully, and with a good deal of skill, to the floor. Once (284th day) when absorbed in a pretzel she was sucking, she let go of the chair she held by, and stood some seconds alone, quite absently and unconsciously, then sat carefully down, — a more difficult thing to do than to let herself down with the help of the chair. In the latter part of the week, it was not uncommon for her to let go of a support and stand alone absent-mindedly, when interested in something she held: she would rarely do it purposely when standing by a chair; but when at some one's knee, where she felt more confidence, she would sometimes now let go in order to try to stand alone (though her deliberate efforts to stand alone were still usually, as the week before, when she had *lifted* her body erect, thus quitting her support). She had incurred bumps from the time she began to roll, and in creeping had often collided sharply with objects, nor had falls been infrequent even thus far in standing; and she had evidently acquired a certain amount of caution. Perhaps this was in part instinctive, as in her refusing to be coaxed into creeping over the edge of the table, though our arms were beneath to catch her. Once (284th day), having failed to sit down as carefully as usual, in her eagerness to creep to her father, she rolled over with a bump that frightened her. On the whole, however, she was very slightly troubled by bumps or falls, and her caution did not amount to timidity. She showed signs of fear on the 283d day, when she had pulled to her feet by a wire dictionary stand, which rocked under her clutch; yet she often fearlessly pulled up by rocking-chairs.

On the 285th day, she deliberately experimented in standing alone as long as she could. I sat on the grass beside her, and she would help herself up by my knee, lift her body erect, balancing with outstretched arms in great glee as long as she could, then come down plump on the grass and try it again. I had not

a watch at hand, but estimated by counting that the longest period for which she kept her balance was about seven seconds.¹

Once in this week, seeing the stair door open, she crept to it and looked upstairs, then got to her feet without anything to hold to or rest her hands on, merely steadying herself by the door-frame, and then turned around to look at the people in the room, — a noticeable advance in equilibrium, though, forgetting in her interest to cling to the door-frame, she lost her balance at once.

I noticed at this time — forty-first week — an intangible but great increase in the baby's appearance of comprehension and mental alertness: the new possession of herself had opened somehow a new era in her psychic life. She often wore a puzzled look, — a curious drawing out and straightening at the corners of the mouth. An increased desire of exploring was becoming apparent. Before this she had investigated objects as they came in her way; now she began to have a passion (which lasted and increased for weeks and months) to go and find what there was to see. Her creeping, which steadily increased in speed and distance, was now purposely utilized to satisfy her curiosity. On the 284th day, e. g., she watched her grandfather as he left the room; then after sitting gravely a moment, crept to the window and climbed up to look after him. On the lawn, she would leave her blanket and make for the edge of the grass to finger the gravel of the walk, or feel over the bark of the trees. She crept into the hall and explored it, sitting down in each corner to survey it, and looking up the walls. She cared little for toys, but occupied herself on the floor for hours together by creeping from chair to chair, from person to person, pulling up to her feet, and setting herself down again cautiously and cleverly; usually smiling and crowing over her success, and sometimes coming to us for applause and caresses. She was unwilling to be taken up from the floor and put into her high-chair for meals, and wished to take her milk standing on the floor, interspersing doses of it with play. She liked to creep fast away from us, laughing, when she thought

¹ It is useful in keeping record of the Instinctive Movements, of Attention, and perhaps some other categories, to learn to count seconds; for a baby gives no notice beforehand when he is going to do something that you will wish to time, and one is often caught without a watch ready.

we were going to pick her up. Her overflowing joy on the lawn at this time I have described elsewhere (p. 250-1), and even indoors her habitual happiness was notable.

In the forty-second week, her delight in standing alone increased, and the length of time for which she could keep her balance grew. She continued the voluntary exercises in standing beside me on the lawn, and once, on the 292d day, becoming interested in looking at something while on her feet, kept her balance for about a quarter of a minute; she could stand longer when her attention was diverted from her own equilibrium. When trying to recover her balance after she had begun to topple, she would use her arms, circling with them exactly as a grown person does when almost falling; the movement (as well as the mere extending of the arms in balancing noticed the week before) seems to be highly instinctive. When she finally came down with a jolt she would break into a peal of laughter.

In this week, she was fond of standing for many minutes at a low window and looking out, watching for the dog and other objects of interest, — another source of mental stimulus and pleasure, obtainable by herself independently, which the power of creeping and standing had opened to her.

On the 293d day occurred what may perhaps be regarded as the first climbing, consisting merely in letting herself down by her arms. She had been seated in a large rocking-chair, and had squirmed about till she was lying on her face, with her feet to the edge, and then let herself skilfully down to the floor. We put her back into the chair, but she could not get herself again into position to drop down; after we placed her in position, she did so very well. Before this she was for a long time very happy in getting up on her feet and exploring the chair-back, leaning to look over it till the chair tipped, to her pleasure; the feeling of an unstable footing did not seem to trouble her at all.

Kneeling, which had declined since she learned to stand, had not been entirely given up. In the forty-second week (291st day) I saw the baby drop from her feet to her knees, while standing by a chair. She was naked at the time, so that I saw the move-

ment well, and the kneeling was quite perfect. In saying that kneeling is not acquired till long after standing, Professor Preyer must mean that it is not until long after a child can stand firmly that he can drop without support from a standing to a kneeling position, — but this is, indeed, not quite easy to a grown person. My niece *rose* to a kneeling position before she could stand, and lowered herself to her knees, with some support, before she could fairly stand alone.

At the end of the forty-second week, the baby was absent for five days on a railroad trip with her parents, and was of course a good deal in their arms. On her return, 299th day, and in the few remaining days of the tenth month, she showed some loss of disposition to stand and creep. She crept for shorter distances, and only to reach some desired place or object; and when the object was at some distance, say twelve or fifteen feet, though she would creep to it when no attention was paid her, she would stop if she was noticed and ask to be carried. She did not desire to be held, however, and was happy in playing about the floor with some one near by, creeping short distances, getting to her feet and down again, and exploring as before, — especially in new rooms. She had not improved in standing at all.

She had, however, made one notable advance, — she proved able, on her return, to step along by a chair, holding to the seat. I had been told of her doing this nearly four weeks earlier, but had never been able to see it; and if there was no mistake about the fact, it must have been a case of accidental or mechanical anticipation of a power, such as is related above under the subject of Grasping (p. 307).

Her walking movements when held had somewhat improved during the month, but were still irregular, and she showed no great disposition to make them.

On the last day of the month occurred what may perhaps more properly be called the first climbing than the mere letting herself down by her arms eleven days earlier: it was, however, to a considerable extent induced. The stairs had for many days in the latter part of the tenth month interested the baby, and she

crept to them and hovered about them, — not so much as if she was desirous of climbing, as because they made a surface for investigation yet untried: and on this day (the 304th) as she hovered about the lower step some one helped her to put her knee up on it. The baby thereupon pulled herself up to the step, and with similar help up two more. I then set a candle on a higher stair, and desiring to reach it, the baby ascended a fourth step without help, quite cleverly.

Eleventh Month: Progress in Standing Alone, Climbing, and Stepping by a Support.

The arrest of progress in standing lasted nearly three weeks in all, extending some ten days into the eleventh month; but there was no *decline*, so far as my record shows: the baby seems to have stood up as much as before, and with conspicuous joy and pride. Her pretty elation when set on her feet in a corner is especially noted on the 312th day: she looked from one to another for notice, calling across the room to members of the family, and leaning forward to make sure that each one saw her. That she was able to lean forward thus (and also to pat her hands) without losing her balance, showed a slowly increasing steadiness on her feet, even during this period of apparently arrested progress.

During the same interval very slight progress was made in any other movement. She appears to have continued to edge along a few steps now and then when holding by a chair, and after the 309th day would step the length of a lounge, holding on with one hand. She would pass from chair to chair, resting a hand on one and reaching as far as possible to touch the next one, and so step across to that with the slightest steadying touch; but she ventured no step alone.

The disposition to creep declined somewhat, though when the baby wished to get anything she could creep quite rapidly. On the 307th day she made quite an advance in intelligence in steering, so to speak. She was in the habit of creeping to me when I called her; but if I called when she was on the floor and I at the opposite end of a table, instead of creeping to me she would creep to the table and, getting to her feet, would stretch up to peer over it at me, as if she did not see how she could reach me through the

obstacle. On this day I leaned far out, so that she could see me behind her mother, who sat at the side of the table, and then she caught the idea of creeping *around* to me. A week later I tried it again, and again had to help her by leaning out to the side; but afterward she often crept around to me. On the 312th day she crept *under* the table while the family sat at it, to find her grandmother, and often did so afterward, directing herself to the proper place very well.

With the 314th day came a sort of fresh start in several directions, almost like the expenditure of accumulated force. On this day the baby lifted herself to her feet by resting her hands on a stone coping not six inches high, — the first time that I had seen her raise herself to stand alone unless some one was close at hand. The same day I set her on her feet in the middle of the lawn: she was proud and interested, and kept her balance about a quarter of a minute, longer than she had ever stood while attending to her equilibrium, though three weeks earlier she had stood as long when interested in something else.

The next day (315th) several notable advances were made in standing, climbing, creeping, and walking, — as well as in some mental activities, not recorded in this chapter. Much of the day was spent outdoors on the lawn, where her great enjoyment seemed to stimulate activity in every way. As she played about me here, I looked up from my work to see her standing quite alone in the middle of the lawn, near no object by which she could have raised herself: she must have risen directly from feet and hands. She was not seen to do this again before the twelfth month. Once as I was preparing a loquat for her to eat, she got to her feet holding to me, and in her eagerness let go and stood before me waiting till the fruit was ready, and while I fed it to her in bits, — a time which I determined pretty closely at one and a half minutes. She seemed tired then, and sank partly down to a kneeling or sitting position, but at once rose again and stood, steadying herself by resting a hand on my wrist, or grasping my sleeve, for about five minutes more. Over and over she stood alone a quarter-minute, without the aid of diversion of attention from the standing. The same day I saw her pull herself up on

tiptoes to look over the seat of her high-chair; and after this, standing on tiptoe to reach or see something is repeatedly mentioned. In spite of the marked improvement in equilibrium, however, she had an especially bad upset on this 315th day, losing hold and balance as she stood by the lounge, and going over backward with a sharp bump, which frightened her unusually.

Until to-day there had been no progress in climbing since the small and induced advance made ten days before: but now, as I sat on the floor, the baby put up one foot into my lap, holding to my shoulder, then with much difficulty and many efforts drew up the other, knee first. This she did three or four times. She also stepped *over* my leg, holding by my arm, the first time she had lifted her foot to set it over an obstacle.

On the lawn the same day, as she played beside me, I set an article that I did not wish her to reach on the other side of me: she sat and looked at it a few seconds, then turned and crept back around me to get it; a decided advance in locomotor idea of direction. As she came near to it, I set it again on the other side of me, and this time she scrambled over my knees to it. After this, in playing about me, she scrambled over me or into my lap several times.

One more achievement of this active day was the discovery that she could push a chair before her, which she twice did, for a couple of steps.

The next day, 316th, as the baby stood alone on the lawn, she saw some one bringing a much-desired glass of water, and in her eagerness took one almost unconscious step forward and promptly collapsed on the grass.

At a neighbor's, she occupied herself for a long time in letting herself down backward from a doorstep, and climbing up it again.

These three days of marked revival of activity brought the baby to the end of the forty-fifth week. During the rest of the month her progress in climbing was the most striking trait of motor development. On the 317th day she climbed of her own accord up two steps of the stairs. Later in the day I set her at it again, and moved on up the stairs before her to induce her to follow, though I did not urge her at all. I wished to see how far

she could go. She toiled on to the top of the flight, fifteen steps, with a rise of $6\frac{1}{2}$ inches; once she fell backward and was caught by her mother, who followed behind for that purpose; and two or three times she slipped back and lost a step, but kept at it diligently. She was greatly pleased to have accomplished it, though out of breath: she pulled to her feet by the post on the landing, hesitated, made some motions to creep down head first, then seeing the remaining steps across the landing (five in number) crept over to them and mounted them. All the way up she occasionally grunted with exertion as she drew herself up a step, and always uttered a satisfied exclamation on achieving it. She did not use her knee this time, but placed one *foot* on the step, reached forward and put her hands on the step next above, and so pulled the other foot up, thus climbing rather than creeping. She was very exultant on reaching the second floor, shouting and laughing. She got to her feet, looked longingly at the garret stairs, and ran her eyes up them to the landing; but before she reached the foot was diverted from them by the sight of a room door open, inviting to exploration.

After this she climbed upstairs again almost daily, at first slipping several times, and getting discouraged and asking to be taken, on the lower stair, but eager to go on after she reached the landing. By the latter part of the forty-sixth week I note neither slips nor discouragement. In the forty-seventh week, she lost interest in the stairs for a few days, but before the end of the week seems to have returned to the exercise, and to have become skilful in climbing, — perhaps caring for it now merely as a means to reach the second floor, no longer as a diversion in itself. She could go up easily and rapidly, rarely slipping, and with but two or three pauses. Twice she started up the garret stairs also, but was diverted from her purpose half way up. She never fell backward after the first ascent, on the 317th day. At a neighbor's, on the 331st day, she found the stairs, and climbed up many times, and set off to explore the upper rooms. The same day at home she several times climbed up five or six steps, then turned and climbed down quite skilfully. By the end of the month, in the forty-eighth week, she climbed up and down stairs rapidly and easily, without any help, and wished to do it many times a day: she would crawl

persistently to the foot of the stairs and start up. Her method of getting down was to slide backward from step to step, just as she did with increasing ease in getting down from a lap. She never slipped, but as she was disposed to stop and stand alone boldly on each step, and was not yet secure on her feet, there was some risk in climbing, and some one always kept close beside her: once only, on the last day of the month (the 335th day), she lost balance in standing thus on the stair, and was frightened, though I caught her.

Meanwhile a remarkable disposition to climb was evident in other ways. Standing by a chair, tub, or other piece of furniture, the baby would put up one foot against it, seeking some higher support (forty-sixth week). The 319th day, sitting in a chair by her bath-tub, which was supported on a box, she set one foot on the edge of the box and one on the rung of the chair, and leaned over to paddle in the water, — kept from falling by me, but resting her weight on her feet. In the forty-seventh week, when she came to any obstacle, she constantly lifted a foot as if to step on or over it. She lifted her foot thus when leaning over the edge of the box where her playthings were kept; when her grandfather lay down on the floor to play with her, she kept trying to step up on him. She could, in this forty-seventh week, manage a step of six or seven inches, with a good hold above, as on the stairs, and could creep over any three or four inch obstacle. The last day of the week she climbed over a leg that was put out as a barrier, a foot above the floor: she threw her body against it, tilted over after several attempts, and slid down head first.

Meanwhile standing was persistent, though the baby's steadiness of balance improved but slowly. She was fond of standing by rocking-chairs and making them rock, either by leaning against them, or by slapping them, which did not seem to disturb her equilibrium. Once (319th day) she persisted in standing up in a hammock, and refused to hold to me, balancing, recovering, tipping against me, and standing again, while I protected her from falling as best I could. In her baby-carriage, she liked to climb to her feet while it was in motion, and lean far out to the side, or forward over the leather strap that protected her from falling. She insisted on standing to be wiped after her bath, instead of

sitting in her mother's lap. She rejoiced still in standing at the window, looking out and laughing at the sights. The 320th day she sneezed while standing alone, without losing balance. The 323d day she stood fearlessly by the wire dictionary holder whose tremulousness had alarmed her a few weeks before, and tried to get its cord off. She was fond of getting to her feet in our laps to play with our hair, etc. By the forty-seventh week she could stand a minute or two quite alone at any time, but was apt to drop down sooner, to avoid a fall: she had lost her sense of novelty and achievement in balancing, and no longer tried to stand as long as she could, but was constantly standing up and sitting down; when on her feet for a long time she kept her hand on some support, however slight. At the beginning of the forty-eighth week I noticed an increased firmness in her standing, and especially when she was occupied in reaching for or holding some object, and unconscious of her equilibrium. On the 331st day, e. g., she stood alone by a basket of toys, leaned over, reached down and took out what she wished, straightened up again, and then shook hard the objects she held in both hands, all without disturbing her balance.

While standing showed so much improvement, and climbing had reached a considerable skill and was eagerly desired, walking interested the baby scarcely at all. She continued to *edge* about a good deal, holding to chairs or lounge, but there was no disposition to forward stepping. When she was held from above, however, she would walk forward with clumsy alternate movements, and we gradually allowed her to take more and more of her own weight in doing this; but she showed no pleasure in it and soon would wish to drop down again: she seemed to find the movement scarcely more normal than a puppy does when one leads him by his fore paws. The first day of the forty-seventh week, however, standing beside me as I sat on the floor, she took my hand and stepped forward, carrying the hand, with my arm outstretched, almost as far backward as it would go. This was more like a real disposition to walk than any she had hitherto shown. A few days later she began to push chairs about a little, stepping after; but she would not take the step till she had to, leaning far

forward as the chair moved: what she cared for was evidently moving the chair, not walking. At the end of the month we found that she could walk pretty well held only by one hand, but she did not care to.

Early in the month (307th day) I had noticed a tendency to rise imperfectly to hands and feet, instead of hands and knees, in creeping fast. The tendency increased throughout the month, and on the 323d day I noticed that every time the baby started off it was on hands and feet, but that after a few steps she would drop to hands and knees. She seemed to like the movement on hands and feet better, but to be unable to keep it up as long.

Besides this rising to hands and feet, sitting back on her heels remained regularly from the many positions connected with creeping in the ninth month.

An incident of the 324th day gives a fair idea of the extent of the baby's command of her body in the latter part of the eleventh month. As she sat in my lap by the lounge, she saw her uncle's sun helmet on the lounge, and climbed over from my lap to the lounge to get it, pulled it down with trouble, let herself carefully down to the floor, and lost hold of the sun helmet, which rolled away. Some diversion occurred here, but presently the baby crept over and pulled the clumsy burden back to my side, climbed up half into my lap, and held the sun helmet up awkwardly for me to put on.

Her enjoyment in playing around and using her powers was still notable: she was happy by the hour exploring from room to room about the floor, lingering over interesting objects, shouting and calling, getting to her feet by chairs and down again, standing up by the book shelves to pull out books, and occasionally sitting down with one to turn the leaves over carefully, climbing the stairs, edging along by chairs and window-sills and creeping across gaps, standing by the window and looking out, reaching up on tiptoe to examine bureau-handles, etc. If I sat down on the floor near where she was playing, she would creep to me, and holding by my arm or knee, pull to her feet and scramble about and over me, sometimes trying to play with my hair, sometimes merely clinging and scrambling, amusing herself by standing up and sitting down,

etc. Outdoors, her happiness in getting about was still greater, but was now somewhat marred by her desire to ramble off for longer distances and over more various surfaces than could be allowed, so that she would beg to be carried in order to get away from her limits, and then constantly wish to be put down to creep; if she had been allowed, she would have made her way by creeping all across the garden. When taken out in the baby-carriage, she would lean out at the side, desiring to get out and use her own powers.

Twelfth Month: Raising Self to the Feet; Climbing; Beginning of Walking Alone.

In the first week of the twelfth month the mother and grandmother told me that the baby was raising herself to her feet in the middle of the floor constantly and easily, — a thing that she must have done on the lawn once, three weeks earlier, but that no one had *seen* her do till now; and I did not see her do it for ten days more, and even then she tipped over immediately. Her standing was certainly quite firm: on the 340th day, e. g., she rejoiced in standing up at the front of a wagon to see the horses go, and let go of the dashboard to wave her hands as she shouted. She could bend down and recover while standing (fiftieth week); and though I do not find any note of longer standing than a minute at a time, this was doubtless because she did not find it comfortable or interesting to stand still longer, not because this was the limit of her ability.

Climbing up and down stairs was a delight all the month. The stairs were among the things most joyously recognized on her return from a few days' absence in the fiftieth week. She climbed as before, planting her feet, and slid down backward; sometimes she amused herself by climbing up a few steps, then sliding rapidly down. Late in the month, 356th day, having climbed to the top of the stairs, she turned and slid down, sometimes head first, sometimes feet first, quite recklessly; this time she might have fallen once or twice had I not caught her, but as a rule she was very firm and safe in these movements, and needed no help at all, though some one always kept close by her. On the 361st day she started

to *creep* down, and crept down four steps perfectly well, once or twice; the next day she crept all the way down, without help, and rapidly. In other ways she showed steadily and increasingly the desire to climb: standing in the bath-tub, she repeatedly put a foot over the edge; on a mattress about two feet high, she crept to the edge, looked over, turned round, and let herself down backward.

During the early part of the month she crept about half the time on hands and feet, but not for many feet continuously; later, the habit declined, but the decline of all creeping was not far off now.

In the forty-ninth week, the baby walked easily when steadied by one hand, but moved her feet clumsily, and once showed a tendency to bring one foot *to* the other, instead of past. She now first showed a little pride in it. On the 342d day she was expecting to go upstairs with me, and as I led her toward the stairs she walked quite well, forgetting herself in her eagerness to go with me.

Up to this time, she had been wearing little soft kid moccasins, but now low shoes with soles were put on her feet (346th day) which may have affected her walking somewhat.

The 347th day, while going from chair to chair, she twice let go of one chair, stood hesitantly, made a movement forward, even a slight hitch forward with her foot, then gave up the idea of venturing to take a step alone, and dropped to the floor and crept, though the space was but a few inches. So for several days more: she was happy by the hour edging and creeping about the room freely, from one object to another; but she would not take a step alone, even when a single short one would traverse the distance she wished to go. On the 350th day her mother coaxed her once or twice into it (as was reported to me), but the day after she would not do it. On the 353d day, again, I was told that she had walked three or four steps, and this time spontaneously; and this I was able to verify the next day, when if she was set against the wall and told to walk, she would step forward. She did it with much sense of insecurity, tottering and taking very short steps, her legs spreading more widely at each one. Once, instead of catching her, I tested how far she could go, and found that she could keep her feet for six steps. She did not give up and sit down, but went on as far as her legs would carry her, with visible sense of achieve-

ment, tremulous, pleased, half-afraid, half-proud; and when she subsided to the floor at the seventh step, she was not at all frightened, but willing to get up and go on, coming down as before after six steps. She could not find courage to try again for several days, however: on the 361st day she tried once, but fell down after a single step. She showed desire to try again, creeping back to the spot against the wall from which she had started, and standing there, but after laughing, waving her arms, and making a false start, she dropped down and crept. In the four days that remained before the close of her first year, she made practically no more progress in walking; yet sometimes when she forgot what she was doing, she would take a step or two to a desired spot. She was really perfectly able to take three or four, from support to support, for she was strong and steady on her feet; but she seemed to have lost her little access of interest in walking, and to prefer to creep. It was curious to compare her doubtful beginning of walking in these last days of the year with her bold and free climbing and sliding on the stairs.

Thirteenth Month: Walking Alone; Climbing; Decline of Creeping.

With the beginning of the second year, walking at last began to develop with energy. On the first day of the year the child walked the length of a room, to the foot of the stairs, (some eighteen feet) holding lightly to my hand, and then walked upstairs in the same way. She stepped up nicely and easily as far as the landing, then lost interest in walking, in her desire to creep down the steps. A few days later she could walk freely holding to one finger. She was still cautious about walking quite alone, but wished to be on her feet, moving about and amusing herself, all the time, and was restless when in the lap or the baby-carriage; and she would from time to time readily enough leave a support for a few steps. She also went about a good deal pushing her little chair, which was of course light and easy to move. During the fifty-third week there were some fluctuations in walking alone, but improvement on the whole; and on the first day of the fifty-fourth week I saw her walk about three feet alone. She was now becoming disin-

clined to get down and creep, and was disposed to take some one's finger and walk across the room instead. She walked clumsily, spreading her legs and rolling a little: but the rolling gait proved to be a permanent trick, which in her seventh year was to a great extent corrected by exercises¹

On the 376th day I was told that she had walked alone across a room, some twelve feet, quite spontaneously; the next day she walked half-way across the same room to me, straddling and rolling, and making grimaces indicative of much pride. The next day she walked to me across the whole width of the room, smiling and proud, walking faster and faster till she was nearly running, and threw herself into my arms with laughter and kisses. Walking with the help of some one's hand was also quite advanced in this week (fifty-fourth): the 377th day, e. g., she took me by the hand and led me across two rooms to the place where her bonnet was kept, then after getting the bonnet on, led me to the outer door. At fifty-four weeks old creeping was almost abandoned, except when she was in a special hurry; then she would drop down and creep. She liked to utilize a chair to walk by when one was in reach, but she would walk alone whenever necessary, and would even lift her arms, or go through gestures while walking; she liked to walk carrying a weight, a doll or book. In the fifty-fifth week she walked much and securely, keeping her footing over slight obstacles, or a rough surface: a door-sill, or a newspaper lying on the floor, e. g., did not seem to trouble her at all, and she kept her feet without difficulty in walking over a tray of almonds spread out to dry. She turned, leaned over to pick up objects, dragged chairs and her tin tub about, and otherwise showed security on her feet. Having overthrown a chair once accidentally, she did it afterward on purpose, without disturbing her own balance by the exertion. Often she partly lost her balance, and recovered; often

¹It is worth while to notice that a child, even of healthy and normal development, whose strength of back and limbs is unquestionable, may have defects of carriage long before these could have been produced by the causes so prolific in later childhood, (such as improper clothing, seats of wrong size or shape, and careless habits); and that his natural activity can not always be trusted to give him symmetry and grace. The pedagogic importance of this fact I shall speak of later.

she went down, but did not seem to mind. She crept far less than she walked. She led people about wherever she wished them to go. When supported under the arms from above, or even once when holding by her mother's hand, she walked upstairs taking *alternate* steps, like a grown person. Her appearance of pride in walking had nearly disappeared, and she took it as a matter of course. She played about, trotting round the room, enjoying her own motions and examining the properties of everything, — experimenting in pushing things about and overturning them, coming to us and looking at our dresses, ribbons, etc., asking the names of objects by an inquiring grunt; looking over her books; looking out of the window and calling to the dog; going off exploring, and bringing objects to us; hanging about us to offer kisses, and then off to explore a closet; and so on by the hour.

In the fifty-sixth week, I noticed that she dragged one foot a little in walking, but it seems to have been a passing trick. She would now, when supported from above, walk downstairs, but not alternately like grown people, as she did in walking upstairs. The increase in steadiness, and speed, and amount of walking was surprising. She would be all the morning outdoors, toddling about, exploring the garden paths. In one morning, she toddled along the paths a distance that amounted to over two hundred feet (with intervals of sitting down to examine the ground), besides making several shorter trips. The space in garden and shrubbery, traversed by paths, is nearly a quarter acre, quite irregularly disposed, so that there was much opportunity for rambling up this path and down that. Her joy in this independence was remarkable, and she could not bear to be restricted, but was always anxious to get down and on her own feet. It was her greatest interest, and an inexhaustible one. She would toddle along, go down on the ground to examine something, ask its name if it was new to her, get up and trot on a little way, then down again; and so on all day long. One day in this week she escaped supervision and got outdoors by herself, and was captured jubilant. Once when outdoors she evaded her mother, toddled round to another door, climbed upstairs by herself to me, and led me downstairs and outdoors with her. She coaxed all day to be allowed to go outdoors, using all her arts. My notes on other subjects are full of

references to her going here and there freely; indeed, walking may be said to have been completely mastered long before the end of the thirteenth month, baby-like as her gait was.

Now and then, when eager, she would increase her speed (as early as the fifty-fifth week) to a sort of trot: in the fifty-sixth week she began the play of running away from people, with shouts of laughter.

She persisted meanwhile in trying to climb, and at fifty-three weeks old succeeded in getting out of the little tin bath-tub; she set one leg over, and after a good deal of doubt, and lifting the wrong one (the one already out), at last got the other one over. She constantly and easily slid down backward from lounges, and over steps; yet I find occasional references to her asking to be set down. She climbed up into her little rocking-chair (fifty-fifth week) and stood holding by the back and rocking it. She was as fond as ever of climbing the stairs, and if she could not go outdoors, coaxed for the stairs as the next best thing. Now and then she evaded guard and came up to me alone, always quite safely. Once (fifty-fifth week) she began to scramble down headlong, but after slipping and rolling, reversed herself and slid down backward as usual. At fifty-five weeks old, she would slide thus off a bed, feet first, but not as safely as from a lounge, since the bed was so high that she would fall if we did not catch her. She liked walking upstairs better than climbing, but did not try it unless supported from above. In the fifty-sixth week, she had a trick of ejaculating constantly, "Shush! shush! shush!" as she climbed the stairs, — apparently a sort of vocal accompanying movement.

**Fourteenth Month: Secure Walking; Beginning of Running;
Progress in Climbing.**

During the fourteenth month the development of steadiness and endurance in walking was considerable: the child's constant desire was to walk about outdoors, and next to go upstairs. All day long she would beg to go outdoors, and once there, would patter around, sitting down and examining objects, then up and on again. Her

usual walk was about 55 yards long, — along the veranda and a gravel drive, up one garden path, and down another; but from day to day she would annex some new strip of territory. One day in the fifty-seventh week she made three trips, of some 140 yards, 85 yards, and 180 yards respectively, — the third one after a nap, and holding by my finger. This was probably a fair sample day at thirteen months old.

Her speed increased perceptibly during the month; I note in the sixtieth week that she "almost runs" when eager; and the expression "trotted about" occurs now and then throughout the month. Her gait was evidently decidedly advanced beyond the toddling of the thirteenth month. Once, when she was sixty weeks old, I use the word "running" of her coming to me, guided by my voice in the dark.

Her increased security of balance was evident from her ability (as early as the fifty-ninth week) to trot about firmly in the dark, without stumbling. She walked boldly over slight irregularities, as doorsills, without the slightest trip. Still, she would often catch her foot, turn too quickly, or trip herself somehow, and sit down suddenly; she rarely fell flat or took any hurt, and usually laughed at these upsets. Especially in reaching her arms up, to express desire for something above her, she was apt to sit down backward (fifty-eighth week). She could stoop over forward and handle things on the floor, sometimes for many minutes (fifty-seventh week) with ease and security; and could lean far forward (fifty-eighth week), to look through a door, e. g., without any risk to balance.

Climbing was a leading interest. Once in the fifty-eighth week, in climbing downstairs, she started face forward, sitting down on a step and putting her feet over, then rising and standing on the lower step, sitting down and putting her feet over again, etc. This, I think, was the method she used in getting down the doorsteps, which she did easily and safely; but it was evidently too tedious for a long flight of steps, and after thus descending two or three, she gave it up, and turned around and slid down swiftly and securely backward, as usual. A few days later in the same week, and again in the next, I note her liking for stepping down like a grown person,

holding some one's hand. It was evident she did not like the sliding down backward, but found no other way so quick and safe. In the sixtieth week she tried hitching from step to step, and went down the whole flight thus, without any help, and with ease and security. This saved the inconvenience of rising and sitting down again on every step, but cost her a good deal of jolting, and was not kept up long. In the fifty-ninth week I found she could climb the stairs in the dark as well as in the light.

In the fifty-eighth week a chest that usually guarded a low window (almost level with the floor) chanced to be moved, and the child tried to get out of the window (some two feet from the ground), and fell out. This made her cautious, but for a day or two she hovered about it, and made essays at climbing out, but did not quite dare trust herself to do so. Another day in the same week she amused herself by climbing up on a footstool (holding to a chair) and standing on it. In the sixtieth week she could get off a lounge or low chair with ease, and was ambitious of climbing up on them as well. One day early in the week she was much elated at finding that she could mount a small trunk, a foot high; she climbed up, sat down on top, and climbed off, many times. When I came home she was proud to show me the achievement, and sat throned on the trunk looking at me with a most elated expression; she wished to keep up the ascending and descending for some time, and kept pointing back to the trunk after she had left it. Later in the week she succeeded in climbing on a lounge (15 inches high), by chancing to try a place where the cushion was depressed with long use; she made many efforts at other places, but the slight difference in height was sufficient to defeat her.

In this month, and later, she was impatient of being held (see *Muscular Sensation*, p. 185). As she was, however, increasingly interested in understanding and using speech, she was on the whole willing to sit longer in our laps, while thus entertained.¹

¹In this month and the preceding, a marked trait was the delay — sometimes many seconds — that the child would make before seizing an object offered, or responding to a suggestion. It seemed as if she were considering the matter, but even when the proposition was highly agreeable, and the assent sudden

Fifteenth Month to End of Third Half-Year.

At fourteen months old the child was in a rudimentary way in possession of the principal race movements of locomotion and equilibrium. Her running, it is true, was no more than a clumsy trot, to which her steps would quicken in eagerness, as in hurrying to meet me at the door; but I doubt whether at any time within the first three years it was the real gait of the adult runner, with the spring from the foot. Certainly it was not until she was directly instructed, in the sixth year, that she learned to keep the heel lifted in running, instead of bringing down the sole flat at every step. Some children do much better than this: a little cousin of hers ran swiftly and correctly in the second year.

It is worth notice that unlike Preyer's child, who began with running and afterward acquired the more difficult art of balancing at a slow pace, my niece came to running by gradual acceleration of her walking. In the sixty-fourth week she ran (or trotted) a great deal; in the sixty-fifth walking was to a great extent aban-

and eager when it did come, there was often the same long, apparently contemplative pause first. I attributed it to the time required for cerebration, but why it occurred in some cases and not in others, or why it occurred now in cases where earlier there had been comparatively prompt seizing, is not clear. It is possible that variations in attention may have accounted for these differences, — the brain may have been somewhat prepossessed with reverie, even when the child seemed attentive; a condition more likely now than earlier. Or the whole action of taking an offered object may have risen to a higher psychic level, involving more of conscious choice. Where the use of words was involved, there is no difficulty in supposing the necessary cerebration to have caused the delay. Certain acts, firmly associated by practice with certain words, as when the child was told to pat her hands or to do some other familiar trick, were promptly performed. In a case where the taught association was a little more complex, — that of waving her hand and saying "By-by" at the departure of any person, — though the action was usually performed, the person addressed would sometimes be quite out of sight before the child began her adieus.

In general, in the first and second years, all reaction times were slow, but the rule had exceptions, the law of which I did not detect: certain acts were always likely to be more quickly performed. (See Grasping, pp. 309, 316, 321, 322.)

doned, and she scampered about habitually at a jogging run, often upsetting (either by tripping or by overbalancing) and not minding it in the least. Her balance in walking was excellent at this time: she could walk impeded with heavy or clumsy objects, and once in the sixty-second week essayed to bring me a gown that she wished me to put on, dragging it across the floor, but gave it up and brought me a pair of shoes as a substitute; she could lift and carry her little rocking-chair (sixty-fourth week); and in the sixty-fifth week (fifteen months old), when frolicking naked by the fire, if told to "kick" or "jump high," would kick one leg out quite freely, without losing her balance.

In the sixteenth month, though on the whole firm on her feet, and constantly running about, she still tripped easily, or miscalculated in turning, reaching, etc., and fell down a good many times every day. She was easily tilted over, — e. g., by throwing back her head to look upward. Yet she showed adaptiveness often in keeping her feet: in the sixty-seventh week, after walking a few moments among dead leaves, she began to lift her feet very high; in the sixty-ninth, she stood firm in a tilting rocking-chair, amused herself by walking back and forth over a box two or three inches high, and stepped easily up and down over the edge of the paved veranda, about three inches high. In the seventy-seventh week she walked over plowed ground pretty well, but noticed the inequalities, saying, "Down!" as she descended a furrow, noticing the downward inclination once or twice before I had perceived it myself.

Her joy in running about, her passion for chasing the cats, her ecstasy over playing chase around the furniture (see *Muscular Sensation*, pp. 193-4), her running away from us with laughter when called, are noted during all the rest of the half-year. She was happy outdoors hour after hour, running a little way, stopping to examine things, then running again. One day in the sixty-sixth week (sixteenth month), when I was out with her for some two hours, she was running and walking all the time, with about four intervals of ten minutes each, when she sat digging, etc., and many intervals of a few seconds to examine some object. I thought her tired at the end of the time, but she was unwilling to stop. In the seventy-first week (seventeenth month) seeing the door ajar, she

ran away, and when sought in a few seconds, had run some 40 or 50 yards off in the garden, and was still racing off as hard as she could go, with laughter and shouts of joy in her liberty. She was enchanted to be allowed to stand naked by the fire and caper (see *Muscular Sensation*, p. 183), but in the seventy-first week tried perpetually to escape and scamper about the room. She was very quick in running up and snatching at some article she was afraid she would not get otherwise (seventy-first week). In the seventy-fourth week, she would cry when brought indoors, and beg tragically, "Go! go! go!" When outdoors in this week, she would run along the drive, saying, "Walk! walk! walk!" in high self-gratulation.

Climbing was a perpetual desire. I have mentioned that in the fourteenth month the child tried to climb into chairs; and early in the fifteenth she set herself earnestly to accomplish this. In the sixty-second week she would put one foot on the rung of a chair, and holding to the seat would lift the other foot from the floor; but it was only after several days' effort that she could get both feet on the rung. After this she tried persistently to pull herself to the seat; but her arms were too short to get hold of the chair-back, and in laying hold of the edges of the seat she could not get a straight pull and so lift her body. She got her knee into the seat repeatedly, but could get no higher. Once in the sixty-fourth week some one gave her the help of a flat hand behind to brace against, and with this help she got into the chair; but it was not till after about nine weeks of persistent effort that she finally climbed into a chair unaided (see next page). Meanwhile she made many other efforts at climbing. She tried to get out of her baby-carriage, saying, "Down! down!" (sixty-second week); she climbed over a pillow to the lounge arm, and stood on it boldly; she climbed in and out of her small tin bath-tub (sixty-sixth week); she took much pleasure in climbing up and standing with one foot on the rung of one chair, the other on the rung of another (sixty-seventh week); she climbed from chairs to the table (sixty-eighth week). In this week she could scramble down unhelped from a bed, sliding backward and letting herself drop, as she had long done in getting down from the lounge. She was at first afraid to

slide down from one bed, which was somewhat higher, without a slight reassuring touch of some one's hands on her; but by the last day of the week slid down alone from this bed also; and after this it soon became a matter of course to slide off any bed. In the sixty-ninth week, she would invert a strong little wooden pail she owned, and holding to her mother, would climb up and stand on it. (As I have mentioned, she would *step* up on and over a box of two or three inches height; but for any height much over this, a six-inch stair, for instance, she had to *climb*, pulling up with her arms, or at least to have the help of a hand.) She climbed a good deal over the arms of chairs, etc. She was not altogether secure in these ventures, — perhaps a little incautious: once she pitched backward head first from the lounge, where she was moving about; but while allowed her independence in climbing she was always closely watched, so she only pitched into some one's arms.

In the seventeenth month, besides the invariable pleasure in free activity outdoors, climbing was the child's greatest interest. In this month (seventy-first week), she at last accomplished her desire of months, and climbed into a chair, — first into a low steamer chair, and then, just at the close of the week, into a rather low arm-chair (sixteen inches) whose arms were easy to lay hold upon; the cushion chanced to be out of it, which made the ascent easier. On gaining the seat, the child exulted, and stood up and sat down with great satisfaction; then said, "Down!" and let herself down backward in her usual way. She evidently felt that she was very high up, — perhaps judging her height by the difficulty of the ascent, — for though she had repeatedly slid down from beds that were higher, she was timid this time about letting go, when her feet were but an inch from the invisible floor, and stretched herself till the tip of a toe touched before she would let go. She immediately climbed back, four times in succession, and later returned to it again; she showed no caution in sliding out after the first time. Once, while standing in the chair, she leaned back and tilted it in jolts for some time. After this, she quickly mastered the armless chairs (seventeen inches in height); and in three days was climbing in and out of them all. By the end of the seventeenth month, she climbed into chairs and sat down as a matter of course.

In the seventy-second week she experimented at stepping downstairs, face forward, without help, almost going over on her nose at each step; she would rush down two or three steps in this manner, bringing up in her mother's lap. After some experimenting, she preferred again to steady herself on the stair by some one's hand. In the seventy-fourth week she again insisted on stepping down without help, pushing away the offered hand; sometimes she would reach up a hand to touch banister or stair-rail, sometimes not. She now stepped down very well and steadily, and liked it; but one of us always kept on the stair just below her, ready to catch her in case of a stumble. She had been, all these latter weeks of the seventeenth month, growing very bold, and barely escaped bad falls, — sometimes did not escape them. In the seventy-second week she insisted on sitting alone on the piano stool, and pushed away my hand; yet sat so insecurely without it that I always held to her dress. In the seventy-third week she tried to climb out of her crib, and sought new places to climb; she was bewitched with climbing.

In the eighteenth month she scampered about the house when in high spirits, climbing from chair to chair with inarticulate sounds of satisfaction. In the seventy-seventh week, however, she showed a certain caution about falling on the stairs, heightened doubtless by warnings. She went up on her feet, holding by the banisters; but coming down seemed more timid, and wished me close to her. She recognized a place where she had fallen a few days before, and turned to look up at me, saying, "Fall!" and also "Fall?" (There is where I fell. Shall I fall?) She would take my hand, then push it away, and from time to time would take hold of my dress for an instant and let go again. She would start down a flight face forward, hesitate, observe, "Fall!" and turn around and begin to scabble down with an ejaculation expressive of confidence and satisfaction; but after about three steps she would stop, get to her feet, shake herself down (taking her little skirts in both hands and shaking them, with evident annoyance in the way they got huddled under her), and start again to step down, face forward; but again showing timidity, yet unwilling to let me give a hand, would hesitate, and take to the old scabbling backward. This interchange of methods happened several times in the course of the

three flights from garret to lower floor. While stepping down, she was annoyed by my dress, trailing on the same step with her, as I kept a step below, ready to catch her in case of a stumble; she stopped and complained, pointing to it, "Dress! 'Way!" As her system of pronunciation was not very intelligible, I did not at first catch her meaning, and she repeated the protest several times. The next day she was still more timid, and even clung to me, on the lower stair, where there are no banisters to hold to, the stair going between walls; on the upper flights, where she could put a hand on the banisters, she was proud to call my attention to the fact that she was walking like a lady: "Lady! Ruth!" Later in the week, starting boldly downstairs, she would stop, waver, say "Fall!" and turn round and back down.

I set her on a carpenter's horse, perhaps six feet high, one day in this week: she was rather sober, but willing, and did not care to cling to me, satisfied as long as I held her dress firmly; but when I would have set her on her feet there, she objected, and seemed timid. The same day, however, she was desirous of climbing a ladder, and pleased when I helped her. A few days later, she was anxious to reach books on a higher shelf than she had before reached; standing in a chair, she soon reached and strained to get higher; I gave her two dictionaries to stand on, and she climbed them with little fear, and then wanted to climb up on the shelves. Yet not a week before, she had fallen backward from a chair while reaching after books, and had been a good deal frightened.

In the seventy-eighth week, she climbed into her high-chair. She did it with difficulty, and failed when she began with the left foot. She then set her right foot very high up, on the foot-rest of the chair, and pulled up with sheer strength of arms till she got her left knee on the seat, then her right, then turned around and sat down easily. Her mother held the chair still while she did this.

At some time between the fifty-eighth week (when I noted definitely that she could not do it) and the sixty-fifth, she had learned to sit down backward in her little rocking-chair, or on a stool. In the sixty-fifth and sixty-sixth weeks she took much

pride in seating herself on her wooden pail: she would pick it up, invert it carefully, turn her back, and cautiously sit down. Often she missed it, but did not fall, as she was on her guard and lowered herself with tense muscles; she would try again until she succeeded in aiming right. One day in the sixty-sixth week she took her tin plate from the table and carried it about the room, inverting it and sitting down on it. Throughout the sixteenth month sitting down backward continued to interest her more or less, and once in the seventeenth month (seventieth week), seeing a tin wash-basin within reach, she took it, set it on the floor, and tried to sit down in it missed it once, but tried again and succeeded. This interested her much and she sat in it for some time, rocking a little. It was her favorite amusement all day to carry this basin around and sit down in it. By the beginning of the eighteenth month she could sit down backward easily in her little chair, and rock it nicely and smoothly, — this last a new accomplishment (seventy-fifth week), and much enjoyed.

During all this period a noticeable trait was the child's interest in doing something novel with her body, apparently in mere curiosity and sense of power. The experiments in sitting down on the bucket and in the basin are instances, and there were many others, from the fifteenth month on. In the sixty-first week she found that she could walk about with her head thrown back, looking at the ceiling, and practiced it for a long time. In the sixty-fifth week she walked about in her father's slippers, lifting her encumbered feet skilfully. At sixteen months old she hit upon the feat of walking backward, and practiced it all day, much interested and amused. The next day some one showed her how to put her hands behind her; this interested her much, and she would do it whenever asked. Seeing her pleasure in any new use of her body, I showed her how to fold her arms; but the little arms were too fat, and she could only cross them, which she did all day with much satisfaction.

In the seventieth week her great joy when indoors was a shallow box, some $2\frac{1}{2}$ inches high, on which she would stand, stepping on and off with endless pleasure. Once she fell, and sat down hard on the edge, but usually had no trouble in stepping on and off. In the

seventy-second week she saw two shallow boxes, one set on the other, and tried to climb up on them; to prevent this unsafe performance, her grandmother placed them both on the floor, some three inches apart; the child then began to get up on one and step over to the other, with much pride. She kept this play up for some time; and later, after amusing herself awhile in another room, she suddenly abandoned her employments and hastened back into the room where the cherry boxes had been, looked around till she spied them set up sideways against the wall, and immediately began to pull them out, saying, "Box!" Getting one, she started to carry it to where they had stood before. Her mother put the two boxes in a convenient place, and there the child stepped up on one, over to the other, and back and forth and down for some time, very happily; then picked up one and carried it — an armful — out into the other room, where she tried placing it in different spots and standing on it, then in another room, and at last took it back to the side of the other box, and tried to set it down there, getting it partly on top of the other; but finally set it in its former place.

It was in the last week of the seventeenth month that I tried the experiment of letting her hang by her hands, and found her well able to do it, and on the whole pleased with the feeling (*Muscular Sensation*, p. 192). Creeping was now unfamiliar enough to be a novelty; and in the eighteenth month (seventy-fifth week) she was charmed when her mother pursued her on hands and knees across the carpet and begged her to continue. The same day, having stumbled and fallen, she amused herself by running around, flinging herself down, and crying, "Down!" Now and then she would turn round and round, saying, "Round! round!" ("Wow! wow!") She was happy many minutes in the seventy-sixth week stepping from one chair to another, a more adventurous repetition of her play with the boxes the month before. Just at the end of this week she was greatly pleased with the discovery that when she had seated herself on her inverted bucket she could tip it forward, bringing herself to her knees.

Fourth Half-Year.

At a year and a half old the child was already so far in possession of her powers of locomotion as to have almost all the pleasure in their exercise that can be had at any time of life, while their novelty still made their ordinary daily use a keen happiness. During the next half-year my notes record an intense and unchanging delight in free movement outdoors. The child had almost never asked to be taken since getting the use of her own legs, and would rarely consent to sit still in a lap. As before, she chased the cats (ninetieth week); ran away laughing to be pursued (during the whole half-year); and delighted, with ecstasies of laughter, in playing chase around the table (nineteenth and twentieth months especially; see p. 194), and in romping of all sorts. She ran about after butterflies (eighty-first week), and frolicked with the dog (eighty-seventh week, ninetieth week, see p. 199); she was fond of stepping from board to board of an old cider-mill frame that lay on the ground (eighty-seventh week, ninetieth week). Sometimes, especially in the later months, she would find less active occupations, as digging in the ground, or picking flowers; but sometimes she would trot about from one thing to another, without interesting herself long in anything, or would run to and fro, rejoicing in the mere power of balanced motion, and exulting aloud, — "Ou' doo'! Ou' doo'!" (eighty-fourth week), or in the eighty-sixth week, "Walk! 'On two little feet'!" (quoting a jingle), — or going into ecstasies of freedom and activity, capering and ejaculating (see pp. 239, 247, 251).

Her perpetual appeal in the twentieth month was, "Walk outdoors!" If she was carried, or any one tried to make her go in an undesired direction, she would repeat it earnestly, — *walk* apparently meaning *walk freely*. Once in this month she was taken on a trip of two days, including a number of changes of cars, and a stop for errands in the city; at all intervals she wished to be walking or running: at the station, she walked up and down a bench, saying, "Back go Ruth!" at each turn; at a restaurant, and at a friend's office, she was excited and eager, slipping down from her chair and wishing to run off and explore everything; on the street, she was determined to go on her own feet, reluctant even to be led, running ahead along the sidewalk with her curious rolling gait, laughing

with joy, and only occasionally stopping to look at anything; if we stopped for shopping, she was soon bored in the store, in spite of all its sights, and was begging to "go ou' doo',—wa' [walk] ou' doo'!" She ran thus for some ten blocks in all, carried over crossings. When we reached the village to which we were bound, she was most discontented at our getting into a carriage, and begged to get out and walk, and as we found that the carriage did not start for some minutes, we indulged her; when the carriage overtook us, she was still reluctant to get in, begging, "Walk! walk!" and on reaching the house we were to visit, she would pay attention to no one, clinging to her mother and begging, "Ou' doo'!—wa' ou' doo'!" The next morning she insisted on running about on her own feet in the strange places for nearly four hours, with the greatest enjoyment,—traversing perhaps a mile in all. In passing through the city again on our return the same day, she ran as before along the sidewalk, waving her arms and shouting with joy of liberty (a somewhat conspicuous little object, which made many passers turn and smile,—a contrast to the other, demurer babies on the street); and on the ferry-boat she insisted on trotting round and round the deck, and was reluctant to stop and go ashore.

After this, she preferred walking even to driving, and one day at the end of the month, hearing something said about driving as her bonnet was put on, was disposed to whimper: "Walk,—walk outdoors!" she protested. At the end of the twenty-first month again, she went off to drive protesting that she wished to "walk on feet." Returning at about 5:30 in the afternoon, after being outdoors since breakfast, her first greeting to me was, "Aunty! Ruth walk outdoors!" (*i. e.*, wishes to). She protested bitterly against going into the house to receive a toy wagon which had been brought for her in her absence, wriggled away from it, and consented to take pleasure in it only when it was brought outdoors.

She had no timidity about wandering off alone; and we often allowed her to do it, watching at a little distance. Possibly she experienced an added sense of freedom and power from the idea that she was alone. In the ninetieth week she started off on a walk, and we followed. She tramped out along the drive to the main road, and tried to climb a fence to go to a neighbor's

and see his ducks and geese; failing in this, and also in an attempt to creep under the fence, she kept on along the highway, running ahead by herself, rushing at the dog and mauling him, or standing and laughing as he charged past her. After she had gone about 360 yards she stopped and tried again to climb the fence, and after failing in this and being stopped in persistent attempts to explore a neighbor's lane, turned homeward, and walked some 18 yards more, till her father, coming by in a buggy, took her up. About this time she began to take wider ranges in her travels round the garden, playing a little while on the walks, then roaming off into the regions of potatoes and corn beyond.

On a trip to the city in the ninetieth week, she behaved just as she had done the month before, — insisting on being on her own feet in the street, and running ahead at the top of her speed, unconcerned if she got far ahead; indifferent to the attractions of the shops, and eager to leave them and "walk." At one time, for a number of blocks, she persisted in sitting down on every step and curb she passed; when carried to prevent this, she struggled, and cried, "Let Ruth walk!" On a street-car she insisted on walking back and forth along the seat that ran along one side (empty, as it chanced), enjoying the way she was flung about by the jolts of the car. In all such cases, as long as she was doing no harm and annoying no one, we let her take her own way, keeping close enough to her in safe places for a vigilant watch, and in unsafe ones, close enough for instant interference; but allowing her to feel as unrestricted as possible.

Camping in the redwood forest in the twenty-second month, she objected at first to the rough ground, and wished to be carried. But on the fourth day a stray dog roamed into camp, and in her interest in him she ran after him over stones and sand in the stream-bed, and tried to scramble up the steep bank after him when he went away. After this she was more independent, and disposed to walk around by herself. On her return from this trip she was more eager than ever to stay outdoors and ramble round: developed some crossness under restraint, unusual to her even disposition, and "Ruth go outdoors!" "Ruth stay outdoors!" was her constant cry. "Let Ruth down!" she cried,

held in my arms merely for the moment that I lifted her from the wagon on her return from a drive: and set on the ground, she trotted about, pointing down every path and saying, "That where Ruth goes!" a curious expression of conscious, remembered joy in her pilgrimages.

Indoors also she often raced about in a random way, in sheer exuberance of spirits and activity, in only less glee than when outdoors, capering, uttering joyous cries and prattle, impatient if held still a moment, — "O aunty, let Tootyboo get down!" "O papa, let Tootyboo walk!"

I have before mentioned especially her remarkable spirits and desire of motion in the twenty-first month, her running about all day, shouting and squealing, and crying, "I-ya! i-ya!"; her ecstasy in scampering about naked, flinging herself down and jumping up, etc. (eighty-ninth week, ninety-fifth week; see p. 183.)

She still tripped and fell often enough to show that her balance was not really firm yet. She probably went down with relaxed muscles, and seemed to feel very little inconvenience from the tumbles, and to regard them as matters of course. "Down you went!" I commented once as she fell. "Go down more," answered the child serenely, tripping again as she picked herself up and went on. She often commented on a fall: "Fell down that time!" (ninetieth week); "Take care!" when she slipped or stumbled, (ninety-first week). Once she missed her chair, in sitting down backward, and sat in a heap on the floor; she picked herself up laughing, not chagrined, but made self-conscious. I have but one record (at twenty months old) of a fall that frightened or discomfited her at all, when walking or running; and this time she was playing with another child, and was perhaps overset by some movement of hers. Once in the twenty-first month I saw her stand on one foot in the bath to scrub the other knee with a brush, balancing only with a slight touch of one hand on the edge of the tub.

The desire to climb continued remarkable, and the half-year showed a good deal of progress in skill in this direction. I have above related (see Muscular Sensation) that in the eighty-third week the child climbed one flight of stairs ten times in succession,

turning around and going back as soon as she reached the bottom, and also took two or three trips up and down another flight; then after a brief excursion into one of the rooms, ascended the stairs again, — about 160 steps in all. This climbing was *stepping* up from stair to stair, holding by the banisters. I have many notes of her pleasure in the exercise. She liked especially the garret stairs, which were guarded with banisters in an open well, while the lower stairs were inclosed between walls and gave her nothing to hold to, as the stair-rail was too high for her. On this lower stair she went down cautiously, remarking, "Might fall!" but on the upper one she was proud to climb without having me close at hand. She handed articles to me to carry, but did not wish to be helped beyond this, even on the lower stair: at eighty-eight and eighty-nine weeks old, she would say, "Own self! own self!" when help was offered, or "Ruth go downstairs own self!" or, "Let Ruth walk!" Once in the eighty-ninth week she slipped away and went upstairs quite alone, stepping, not creeping, without any timidity. Climbing the stairs once, in this same week, to avoid setting her foot on a pasteboard box that stood on one step, instead of bringing her left foot to her right, she carried it *past*, to a higher step, as an adult does, and as she had formerly done when walking up with the help of a hand; and with the help of the banister, she made the extra step with little difficulty. Going down the same day, she stepped several steps quite unaided, without touching a banister, but usually preferred to hold lightly. In the one hundredth week, I was told that she had started upstairs after some one, and had fallen, — the first real fall on the stairs that I have recorded, though I have notes of her stumbling, — and cried hard, but insisted on going up again. The next day, when reminded of it and asked if it hurt her, she seemed somewhat annoyed and abashed, and said "No, — that did n't hurt Ruth anything!" — perhaps fearing her freedom in climbing the stairs might be restricted.

In the eighty-seventh week she took pleasure in *sliding* down-stairs, sitting on a step and sliding gradually over the edge, coming down with a thud, saying as she did so, "O, o, o, o-o." In the ninety-first she liked to slide down on her feet, holding some one's hand, and sliding from step to step with a racking jolt (see p. 204, 205, 207, note).

She had many other ambitions in climbing, apart from the stairs. She wished, as earlier, to climb up on tables and desks and explore pigeon-holes, examine pens, etc. (eightieth week, e. g.). "Climb up, climb up!" she said (eighty-ninth week), pretending to climb a tree; in the ninetieth week, she climbed up five steps of a steep ladder-stair, saying, "Ladder!" She climbed down with the help of my hands, stepping securely enough, and turned to climb again, but gave up after one step, apparently a little intimidated by the difficulty of the descent. Two days later, at a neighbor's, several older children took her up a ladder to a hay loft: she went with entire confidence, needing no help in climbing, and after she had been brought down, went up half a dozen steps several times, with no one behind her, only arms below ready to catch her at need. Later in the same week I found her standing on a board that propped the clothes-line, teetering it up and down and crying, "Ruth ride!" Presently she sat down astride it, and continued to teeter. At my suggestion, she took my hands and walked up the steep incline to the top; and on reaching the ground she wished to do it again.

She now (ninety-first week) began climbing ladders wherever she saw them, going half way up, to "pick leaves," e. g., — getting her leaves, and coming down successfully. I always allowed her to do this, standing close by — or following her if she went above my reach — with a firm hold on her skirts, or with my arms ready to close about her at the slightest stumble. She climbed very firmly and cautiously, however, and I have no record or memory of ever seeing her make a slip. Climbing, indeed, where hands and feet are both used, seems to me a safer exercise for a baby than people think: on an exposed high place, standing or sitting, still more walking, a little thing is apt to lose balance, but when climbing with all fours, so to speak, conscious of the insecurity, it seems quite able to take care of itself.

At just twenty-one months old, the child climbed a ladder to the top, all but the very top ledge, over which she leaned and looked down the other side without the least timidity, — nine steps. She started up another, but after some five steps came to a step that was worn narrow, and at once stopped, said, "Go down!" and climbed back. She then wished to be put up into a seat

on the high judge's stand, above the tennis court; she had before been timid about this seat, but now when I held to her dress, she pushed away my hand with annoyance; sat awhile, interested in the height, then scrambled out of the seat, observing that she wished to sit "down there," on the platform itself, picked her way carefully out on the narrow ledge of platform beside the chair, then started to let herself down backward (four feet) without fear. In a hammock, she was much annoyed by my keeping hold of the edges, but came near falling out when she tried to push my hands away, and gave up her resistance. I note on the next day that she is at this period "possessed to climb." She would even try, when driving, to climb up the rods that supported the phaeton top.

During the fortnight in camp in the twenty-second month, she was at first timid about climbing, as she was about walking on the rough ground. The tent was at the top of a bank that descended quite steeply to the creek bed, and at first she had to be carried here: but after the fourth day, when she ran after a dog (see above) and tried to climb the bank after him, she lost timidity, and insisted on being allowed to go up and down between tent and camp fire on her own feet, with help, and once or twice started alone, sliding recklessly down the steep incline. She clambered up into a high seat her father had made her between two saplings, and amused herself by sitting on the arm of it. Her mother records that she climbed up the low-sloping roots of a redwood, to where they joined the trunk, and taking hold of a projecting bit of bark, set her little foot up against the 200-foot column of the tree, and made a tremendous effort to ascend, saying, "Ruth climb tree!" She tried to go up the bank alone but had to give it up, saying, "Ruth can't go up this hill!"

In the ninety-fifth week, after her return, she saw a ladder flat against a wall, and rushed to climb it, and tugged up some steps; then, thinking it not safe, I asked her uncle to set it out from the wall; he did so, but left it very steep, perhaps at half the angle used by the men in picking fruit; she climbed it, however, to the top, saying over and over, "See this child climb ladder!" (which I may have said in calling her uncle.) Whenever it shook, she said to me, as I climbed behind her, "This ladder won't fall." At

the top, she reached up higher, disappointed to stop. I set her on the top, where she sat fearlessly, and when once I had set her foot on the first step of the descent again, scrambled down without help. I held her dress firmly all the time, without giving her any aid in climbing. She wished to ascend again at once, and asked to "climb *that* ladder," pointing to the house-wall (where the "rustic" boarding showed projecting edges), and up to the wide ledge over a door-frame.

In the ninety-sixth week, she was much displeased if she was set in her high-chair; she must always climb up. She was proud of this ability, and usually called to me to "look at Ruth climb!"

From the fifteenth month the child had in a way understood the word *jump*, and would try to obey the direction, but only by springing with her body, bending her knees, but not lifting her feet from the ground. This springing movement with the trunk muscles seemed very instinctive, beginning, as I have said, in the earliest months, and continuing still as a demonstration of joy and excitement, — e. g., when she was camping in the twenty-second month and I joined the party, on seeing me at the car window she jumped up and down in a marked manner, though she was not able to lift her feet and jump clear. She was ambitious to do so, and once in the eighty-second week practised a long time, trying to learn the movement from her parents: she would watch them, and bend her knees just as they did, but could not raise both feet. In the ninety-first week, a few days before she was twenty-one months old, seeing an older child, a boy, jumping along the paved veranda, she ran along behind him, eager to imitate, squatting down and making a motion with her body as if to jump, then *running* forward about the space of his jump, and squatting again when he did, and so on. This was only one of many efforts to imitate jumping. She did not, however, seem to be aware of her failure, but pranced cheerfully, and called it jumping. One day in the ninety-seventh week, when she was making many experiments, as squatting and waddling (see below) she tried a great deal to jump off a step, squatting as if to jump, and then *stepping* off, — yet several times did approach nearly to a real jump. At twenty-three months old, she caught the move-

ment, and began really to jump with both feet. She was delighted with her achievement of this long-desired accomplishment, and for the next ten days I have frequent notes of her practising it (up to the one hundred and second week); after that, it ceased, apparently, to interest so much. She seems to have struck it at last by pure accident.

As in the preceding months she liked new experiments in using her body. She amused herself with trying to walk about with eyes shut and covered with her hands, and kept this up till she had had several falls (eighty-fourth week); walking on the road, she enjoyed scuffing along in dusty places (eighty-sixth week); she continued occasionally to experiment at walking backward; she squatted down and in this position waddled along (ninety-seventh week), much amused at the curious gait, crying, "Ruth walk this way!" She amused herself a long time running about while leaning back as far as possible, then squatting and waddling. She was interested also, the same day, in efforts to jump, (see above); and in creeping about the lawn, saying, "See Ruth crawl!" (I find an occasional reference to her creeping under the table, but on the whole the quadrupedal mode of progression seems to have been promptly abandoned as soon as she could walk.) In the twenty-third month, she was enchanted to be run off her feet by two people taking each an arm (holding her well supported with arm and hand) and running, either on a level or downstairs. She would run to the other members of the family, crying, "Ruth *ran!* Ruth did run this way!" with excited gestures; her own intensified activity, rather than the passive motion, seemed to impress her.

Third Year.

In the third year, my notes record little farther development of the movements of balance and locomotion, — which were, in fact, practically acquired for life before the close of the second year. With the increasing development of intelligence, the child's interests and occupations grew more varied, and the mere pleasure of using her bodily powers fell into the background. When she was taken to the city on the day after her second birthday and thereafter,

instead of caring only to run on the sidewalk, she was silently and happily occupied on the cars in watching the people, and the sights from the windows, and accompanied us decorously on the streets and in the shops. Her desire to be outdoors, though it did not wane, seemed not so much as before for the sake of mere free movement, which was now a matter of course to her, not an active pleasure in itself. She went about picking flowers, dragged her little wagon about, and chased the cats, as before; she was all the year as fond as ever of running away in joke when called, — a trick that in time had to be stopped, — and of playing chase, or "bear," a more dramatized form of the same thing: but in all this, the mere bodily activity became more and more subordinated to the mental element. There were many ebullitions of high physical spirits, in which running, frisking, jumping were mere overflows of muscular exuberance, — but this also was a different thing from the enjoyment of the movements for their own sakes, as interesting attainments, in the year before. She still loved to go on rambles, and the distances to which she would wander off, if one left her to choose the road, increased: she was apt, however, to have some objective point, as the neighbor's farmyard, the creek that crossed the ranch a half mile away. This last walk (a favorite one from the thirty-second month on) is the longest I have recorded during the year, and in this, or even in shorter ones, she would ask to be carried from time to time, — almost always on rough ground. She was willing to be wheeled in her carriage, or taken driving, instead of insisting on her own feet (this I note in the thirty-fifth month and afterward).

She could still be tripped now and then: I have one note, in the twenty-ninth month, of her falling, on rough ground. Later, in the thirty-fifth month, she discovered that she could stand on one foot, and called my attention to it: she was interested in doing it, and could keep her balance for five or six seconds, which indicates a pretty complete mastery of equilibrium in standing.

Climbing continued an interest in itself, and her ability to climb increased: indeed, as every year offered more difficult feats in climbing to her, as she grew more skilful, this power never altogether ceased to afford the interest of novelty. On the stairs she

insisted on walking. I note a remonstrance in the twenty-sixth month, when her mother wished to carry her downstairs: "I walk all the time!" By the end of this month, she was really able to go up and down alone without the least oversight, and I refer to her coming upstairs to me as a matter of course. Although my notes are not clear on the point, it is my impression that there was still an effort to follow her in these trips, for safety's sake; but in the twenty-seventh month I have several notes of her running away and coming upstairs quite alone. She was in the habit of having a chat with me in the dark in my room every evening between dinner and bedtime, and I have several notes of her rambling off by herself before I was ready, and going up alone in the dark to my room. Certainly before the end of the twenty-seventh month we let her go up and down freely alone, and she was as secure on the stairs as a grown person.

Her acrobatics on the train in the twenty-eighth month, — climbing over the back of a seat, and up to the window ledge, to fling herself backward into our laps — have been mentioned (p. 207). In the twenty-ninth month, she climbed over a stack of boxes with a good deal of skill and persistence: in the thirtieth I note a disposition to climb anything that offers footing, — trees with low branches (that is to say, a few inches from the ground), ladders, carpenters' horses, etc. I observed in this month that her method of climbing was just the same as that of an older person, pulling up with her hands and putting her knee on the surface she wished to reach: she had used the knee thus from the very first effort to climb a step. Once in this month she slid boldly down from some mattresses, piled high on a bedstead, to a chair, too far below for her feet to touch. At another time, she climbed into a tree for some hard and worthless fruits, which I allowed her to gather to play with: she got up a foot or so from the ground, and labored for a long time to reach as many as possible of the little fruits, coming down to put them into my pocket, and climbing up again, and stretching herself up as far as she could to reach them. Although at this time, as a rule, rather averse to hard exertion, she would pull and tug valiantly to climb. From the thirty-third month she was fond of climbing up into the high judge's seat above the tennis court. In the thirty-fourth, in camp in the Sierra, one of her chief joys was to climb

over the rocks and logs, and she was ambitious and entirely fearless in this: she would tug up the rocks, saying at each step, "Higher yet! higher yet!" like Longfellow's youth. She was dressed in trousers and overalls, which helped her climbing.

Jumping did not become a common feat. I have notes from the twenty-ninth month of her "jumping about" in high spirits, but I do not know just what the movement referred to was, — probably not strictly jumping. In the thirty-second month, she practised jumping from the lounge, evidently a little afraid, yet desirous of doing it; later, holding my hand to steady herself, she did it very well. Again in the thirty-fifth month she had a spell of practicing at jumping from a step.

She still liked, now and then, to fall back on the earlier and simpler motions and positions. I note a fondness for rolling about on a bed in the twenty-fifth month (and doubtless at other times that I have failed to note: in this year, as the matters to be recorded grew more complex, I could not keep complete record of anything but steps in *advance* in the principal movements). In the thirtieth month I note her rolling about the floor, and add that this rolling about, flat on back or side, seems to afford her now and then great physical comfort, and that she is at all times very ready to lie down on the floor. Rolling on the lawn in the same month, he begged me to join her: "You ain't too big. I will show you, how to roll over and over. Just this way." She could not steer herself at all, and when asked if she could roll to any given place, she would try it, and shout, "Yes! I can roll to the jasmine!" or say, "No, — I can't," according as she had happened to bring up in the desired region or not. She amused herself once in the twenty-seventh month by creeping upstairs, as she had done at first (and indeed, at seven years old she will do this, as well as experimenting in all other possible ways of getting up and down stairs, — sliding, hitching, etc.).

I observed in the thirtieth month that she still sat flat on the floor with legs turned outward at the knees; at no such angle as in the first year, but in a position that I found impossible myself.

The position is to be obtained by resting on hands and knees, and then lifting the body backward to a sitting position; but it requires a flexibility of the leg joints possessed by few adults. The child finds it difficult at seven years, but can do it (see p. 340).

In the latter part of the twenty-first month, I was told that when supported in deep water to swim, the child paddled like a dog some twenty feet: but this I did not see, nor was there ever opportunity to repeat the experiment till she was nearly six years old; at this time she showed no instinctive ability to swim, but was quick in learning to balance her body, and would probably have learned to swim with a few lessons.

INSTINCTS CONNECTED WITH FOOD-TAKING.

SUCKING, LICKING, SMACKING, BITING, SPITTING OUT.

Sucking, if it is to be classed as an instinctive, not a reflex, movement, is the most perfect and probably the earliest instinct in the human infant. That it is properly an instinct, and not a reflex, I think we must admit. As Preyer points out, although the movement is perfectly performed at birth upon the proper peripheral stimulus, the touch of a suitable object between the lips, yet it may begin without the peripheral touch (perhaps by central initiation, as in dreaming); instead of being quickly exhausted, like other reflexes, it goes on continuously till hunger is satisfied, then stops, without any change in the pressure on the lips having taken place, — indeed, if the infant is not hungry, sucking may fail to follow at all on the touch of the nipple, which may be rejected from the mouth instead, of being laid hold on and sucked; and instead of becoming more firmly consolidated in its reflex character with repetition, sucking loses, as we grow older, the traits of a reflex that it at first possessed, and becomes purely voluntary.

This movement appeared in the case of my niece as soon as she was put to the breast, and was vigorous and perfect. In the early weeks, objects accidentally put into her mouth were sucked, but this of course rarely happened before she could guide her hands to her mouth. From the fourth week, throughout the second month and into the third, she had a habit, if held against one's face when hungry, of laying hold on the cheek with her lips, and sucking frantically. At two months old, she would suck the cheek if hungry, but if not hungry would put her mouth on it and *lick* it. This is the earliest mention I find of licking; but on its first appearance the movement was well co-ordinated and definite. (The *feeling* with the tongue about the lips, in the seventh week, had of course resembled licking, but was a much more indefinite movement.)

In the third month appeared the marked enjoyment of sucking as a soothing sensation, — first in the case of sucking the thumb, then in the use of the rubber nipple, associated for more than a year with going to sleep (above, pp. 265-7). In the same month, suck-

ing, and also smacking the lips, were expressions of hunger; but in the latter part of the fourth the baby frequently pursed her lips and made sucking and smacking sounds, without any connection with hunger, or any reason that I could discern. (In the eighth month and again in the fifteenth there was a marked habit of smacking the lips, — beginning in both cases over the eating of sugar, and continuing for several days: the child would begin smacking vigorously every now and then, and keep it up for some seconds. In the eighth month this would be done without apparent suggestion or object, but in the fifteenth month the smacking was clearly a sign of desire for food.) As she lay asleep at sixteen weeks old, I saw her repeatedly sucking, though she had been fed shortly before she fell asleep.

In the middle of the fourth month, the baby instead of sucking a finger put into her mouth, began to *bite* down on it with her toothless jaws, quite persistently. After this, her rattle handle, rubber rings, etc., were not only sucked but also chewed and mumbled with her jaws. The sucking alone still gave much contentment, and I find it mentioned as an accompaniment of tranquil attention; but the notes of biting increase. In the nineteenth week, she began the trick above described (Muscular Sensation, p. 189) of holding the rubber of her rattle between her jaws, and jerking it out. Besides biting down hard on a finger, she would now, when lifted to one's face, bite at chin and cheek, instead of sucking or licking. Objects that offered pretty firm resistance were preferred to softer ones, both for biting and for sucking: e. g., a wooden tip on one of her rattles was preferred to a rubber ring attached to it and intended for biting.

It was evident that the new disposition to bite was connected with dentition. The teeth were now growing up through the gum, and the irritation of their growth must have been the stimulus to the movement: after the appearance of the first pair, at twenty-two weeks old, there seems to have been less disposition to bite, and indeed, after this I have but one note of biting (viz., that at twenty-eight weeks old she bit a hole through a rubber nipple) during the rest of the sixth month and the whole of the seventh. The biting action may have served to allay some irritation in the gums, yet I

cannot think that it was accidentally hit upon, and then continued for the sake of the relief it was found to afford: it began with a definiteness and persistence that made it seem highly instinctive in character; the baby was impelled to it without visible reason, as the time for its usefulness approached. Moreover, as the teeth began to press close under the skin, and the baby was apt to hurt herself in biting, she still persisted in the movement.

After the appearance of the teeth and the cessation of biting just spoken of, notes of sucking become again more frequent. In the last week of the sixth month the baby put her mouth to my cheek, sucking at it, and also licking and mouthing, as she used to do at two months old. Later in the same week (179th day) she had been playing with some oranges in a dish, and ended by putting her mouth down to the dish, and sucking and licking it, then began to lick and mouth the oranges, putting her head down to them; in this, she was evidently finishing a hand-investigation of their properties by appealing to the tactile sense of lips and tongue. She was a little disposed for a week or two in the eighth month to suck her thumb.

With the close of the seventh month, I find once more notes of biting. At seven months old, in sucking bits of orange, the baby crushed them with her teeth, and a few days later (214th day) set her teeth into loquats given her to suck. She evidently had in this no idea of *eating*, nor even of dividing anything with her teeth: even, ten days later, at thirty-two weeks old, when she had somewhat persistently bitten in two some pieces of orange that were held to her mouth to be sucked, she seemed puzzled at feeling the divided half in her mouth, and had no idea of swallowing it. Soon after this there began, together with evidences that more teeth had started, another period of noticeable disposition to bite and chew (probably thirty-third week, — first noted in the thirty-fourth) and it appeared decidedly to stimulate the baby's deficient appetite to be able to *chew* at something, as a bit of dried beef or a bread-crust; and from this time on, the desire to masticate in connection with food became more and more imperative¹ (see pp. 331-2).

¹One must hesitate in questioning the verdict of those competent medical authorities who object to any food that requires mastication before the appear-

Given loquats, she would promptly bite them in two, and could no longer be trusted to suck at them for the juice (thirty-sixth week). She bit at all sorts of objects, sometimes hard ones, as a bottle, hurting her sensitive gums. The third tooth came through in the thirty-sixth week, and three more in the thirty-ninth. Having now both upper and lower incisors, the baby began to masticate properly, so far as the incisors alone sufficed, and was eager to do it: her chewing was no longer the blind, instinctive movement it had been earlier, and was aptly joined with swallowing movements. Dry crackers were preferred to bread-crusts, perhaps because they crunched more crisply under the teeth, and were chewed and swallowed neatly. By the end of the eleventh month — the baby having now seven teeth — a bit of steak was chewed and swallowed, instead of being sucked; and when a piece too tough to tear with the teeth was given her, she was annoyed, and refused to suck it. Pretzels only she would suck and lick, being chiefly interested in the salt surface. At the end of the twelfth month, she would bite through the skin of an apple, taking out bits of skin and flesh, as skilfully as a grown person, so that apples could no longer be trusted in her hands to be rolled about and played with.

She still sucked and chewed at uneatable objects that got into her hands, though both tricks declined as she came to require more complex and mental interest from objects than the mere investigation of their surfaces.

There was a recurrence of seizing at our faces as we held her, and putting her lips to them, sometimes biting (tenth and eleventh months), but licking and sucking no longer appeared at such times; and there was a visible tendency toward differentiation in the eleventh month, the applications of the mouth becoming expressions of friendliness, out of which kissing developed, while the biting was done in rough play, and connected with snatching at the hair,

ance of the molars: yet it is impossible not to wonder if they do not underrate the significance of the strong instinct to masticate food which appears with the *incisors*, perhaps a year earlier. I find the suggestion backed by the opinion of Dr. Joseph Le Conte; and also by that of some experienced family physicians. There is no doubt that the weight of authority among specialists in the care of children is against it.

etc.¹ The baby would begin with the caressing touches, then end in biting, as if the opportunity had suggested the use of her teeth; and there was always something instinctive and non-volitional about the action, in spite of its connection with other manifestations of a spirit of rough romping, — it seemed as though she felt somehow *impelled* to use her teeth. This trick recurred at intervals in the second year, being noted every month up to the sixteenth, after which it disappeared for months, reappearing in the middle of the twenty-first month, persisting throughout the month, then disappearing again (not without a little discipline), until the latter part of the twenty-seventh month, when for a couple of weeks, extending into the twenty-eighth month, I find the trick often mentioned. Late in the thirtieth month, it returned with peculiar force, and for about three weeks was persistent. The child would rush up to a person and laughingly set her teeth in, like a romping puppy. Reproof seemed only to infix the disposition, by a sort of converse suggestion, and set her to doing it again, defiantly, yet gayly, and without a particle of ill temper. Before the end of the thirty-first month, this impulse passed away, or yielded to discipline; but in the thirty-fifth, among sundry methods of misbehavior toward her kitten, there was for about a week a persistent impulse to *bite* it; she probably hit upon this by accident, as she was cuddling the kitten to her face, when it suddenly occurred to her to put its head into her mouth and bite it, till the kitten cried out. We stopped this — or it passed away independently of our efforts — in a few days; but once in the next week she could not resist putting the tip of the kitten's tail into her mouth and biting it. After this, though she remained disposed to rough play, and biting as well as other roughness did reappear, there were no more such noticeable fits of impulse.

The child's mother says that sportive biting was a habit of her own at perhaps four years old, and was broken up with difficulty: as far as she can recall her feelings, she acted under an irresistible physical impulse, and felt keen physical satisfaction in the sensation

¹ It is worth noticing that the word *bite* was at first (sixteenth month) confused with *kiss*; even in the eighteenth month the words seemed to be occasionally confused with each other, and with "eat," but this may have been in play.

of biting down on some one's skin; there was no ill temper at all in it. During the month when biting seemed most persistent and uncontrollable in my niece, I was disposed to connect it with dentition, noticing that at the time she had her thumb in her mouth a good deal, biting it, or feeling her gum (not sucking it). But a comparison of dates throughout fails to show any constant connection between the growth of teeth and the periods of disposition to bite. It is likely that such a connection existed, but was impossible to trace, because the *earliest* growth of the teeth, far below the gum, could not be fixed by date. Certainly there was no relation between the dates of their appearance through the skin and the biting.¹ Nor was the trick simply part of the child's general

¹ I did not keep a careful account of the appearance of the teeth, but find incidental notes of most of them. It may be of some interest to append the record, though I suppose that, apart from the relation of dentition to health, spirits, food, and such small instinctive habits as the one above described (which relation I have already pointed out in the proper places), this record has about as little developmental interest and value as anything that could be noted by the observer of an infant; besides being a subject on which further record is not needed, since physicians of infancy have already very complete records of the process of dentition. However, for what it is worth, I append it:

154th day (22 weeks old), lower first incisor.

156th day (23d week), lower first incisor.

250th day (36th week), upper first incisor, right.

269th day (39th week), upper first incisor, left.

272d day (39th week), lower second incisor, right.

272d day (39th week), upper second incisor, right.

294th day (42 weeks old), lower second incisor, left.

? (nearly a year old), upper second incisor, left.

446th day (15th month), upper first molar, right.

489th day (16 months old), upper first molar, left.

About 533d day (18th month), eyetooth.

535th day (18th month), lower first molar.

? (19th month), lower canine, left.

566th day (19th month), eyetooth.

578th day (19 months old), lower canine, right.

602d day (20th month), lower first molar.

27th month, latter half, 2 second molars.

The other two milk-teeth were not yet cut in the thirty-first month, when I fancied their growth might have something to do with the child's persistent biting; but I have no record of their appearance.

In the thirty-first month, the dentist discovered a tiny hole in one of the molars, too minute to be filled; and on the child's third birthday he filled two

romping, coming and going as the fits of rough play did; for there were many periods of strong disposition to rough play, with slapping, snatching at our hair, etc., without any appearance of the impulse to bite.

From the first, the baby thrust the nipple from her mouth quite neatly with her tongue, when she was satisfied. She had no further ability to spit anything out, however, and when she first tasted a novel liquid, on the 214th day (about seven months old) she merely dropped her jaw and let it trickle out. About a month later when her greater freedom of movement enabled her to get many small foreign bodies into her mouth, as bits of paper, flower petals, etc., which we would at once take out, she began to assist us by getting the object to the tip of her tongue: in the tenth month, when told to thrust such things out of her mouth, she would get them cleverly to the tip of her tongue, scraping the roof of her mouth with a comical little sound, and put her tongue out to let us take the object from it. By the end of the twentieth month, she could spit out objects (as the stones of loquats) easily.

Other Instinctive Movements.

Pushing with the feet began very early (pp. 180, 189, note), and if not reflex, was highly instinctive, probably having some anticipatory connection with the development later of the locomotor and balancing movements, — under which head instances of the movement will be found (p. 334). Pushing and pulling with the hands were among the earliest movements following on the acquirement of grasping; indeed, they were to some extent involved in the vague fumbings that preceded grasping. Like creeping, they did not seem in a high degree instinctive movements; they were rather selected ones, from among the many vague ones used in the baby's early random manipulations of objects; there must have been a

small holes, leaving two others as too small to be operated on yet. This is probably unusually early for the milk-teeth to show decay, — almost upon their appearance, — and the child inherits bad teeth on her father's side: but even though hers is an unusual case, it is safe to draw the general moral that inspection by a dentist can hardly be begun too early.

certain predisposition to them, if only in their necessary relation to anatomical structure; but I saw little of that immediate, unacquired adaptiveness in the movements, or strong impulse toward them, which characterized the true instincts. The one exception was the case of pulling with the arms to raise herself (see *Sitting*, p. 328), which did seem instinctive. One may see, also, a certain instinctive element in the great fancy for pulling against resistance (*Muscular Sensation*, pp. 189-90).

In the eleventh and twelfth months, the mere exercise of these elementary manipulations, pushing and pulling objects about, made up a surprisingly large part of the baby's "play," and afforded a really remarkable amount of interest and pleasure, — pulling down books from shelves, opening and shutting doors, etc. In the second year, in larger variety, much of her play was still to be analyzed into the mere use of these movements, — as in dragging about a little wagon, etc.

Kicking, as an instinctive movement, having adaptiveness, did not appear early. The mere muscular exercise of kicking was common in the early months (pp. 187-9); and kicking the legs up instead of making walking motions has already been mentioned in the account of the movements of locomotion. Throwing one leg out in a purely imitative way, when told to "kick," was done with some skill from the fifteenth month (how the movement originated, whether spontaneous or taught the child in sport by some one, I do not know); and up to thirty months old, the word was still understood only thus intransitively: the idea of kicking an object had not appeared. Kicking her heels backward, against a seat she was sitting on (twenty-second month), or even swinging them forward (against the prop of her nursery chair tray, e. g.) I do not count as true kicking. So far as I know, she never saw any one kick an object, and when the movement did appear, it must have been quite instinctively. The first record I have of it is on the 683d day, twenty-third month, when the child was seized with an impulse to kick a toad, insisting that she "must kick toad;" and after this, she occasionally showed desire to kick small animals. It was one of her methods of misbehavior toward her kitten, in the latter half of the third year. There did not seem to be

animosity in it, certainly not anger; the source of the apparently uncontrollable impulse was hard to define. Kicking never entered into her rough play with us.

Slapping and striking, however, was from the twelfth month, a common action in this roguish roughness. At intervals during the whole of the second and third year, the child would, when taken in arms, slap merrily at our faces, snatch at our hair, etc.; by the end of the nineteenth month she would strike with a stick, and later it was the presence of a stick in her hand that seemed to bewitch her to strike and bang with it, — not at people so often as at any object that she could make a good bang on, as the furniture; but even as late as the thirty-sixth month, and on into the fourth year, I have notes of her striking people merely because she found a convenient stick in her hand (pp. 196-7). In the thirty-fourth month, she slapped her kitten sometimes, without discernible motive. I find but a single note of her ever striking in anger: this was when her grandmother held her still to be wiped, when she was in romping spirits after her bath (thirty-fifth month).

In the latter part of the eleventh month, the trick of stiffening the body in resistance to being taken out of the bath, was acquired. This seems to have been purely instinctive, for the baby could hardly have known that it made it more difficult to lift her: it may have been more an expressive than resisting movement, however. In the thirteenth and fourteenth month (as has been related under *Muscular Sensation*, p. 185), if not interested when some one was holding her, or not desiring to be lifted, she would stiffen and wriggle away, or else, in the case of being lifted, would raise her arms and relax all her muscles limply, so that she would slip through the grasp, — also a highly instinctive device, it would appear. I note this slipping out of the hands now and then afterwards; but wriggling away was the commonest form of resistance; a sharp *twisting* away was observed in the eighteenth month. Direct pulling back was never noticed. The child appeared instinctively to feel the insufficiency of her strength in such resistance.

The development of sniffing has already been mentioned, under Smell. This movement, beginning in the early months as a mere muscular exercise, or an expression of gayety, was later associated with smelling by deliberate teaching, and had no marked instinctive character; though it was doubtless, like many other movements, acquired more readily because of predisposition to the act.

Some other movements, as throwing, might be considered so completely race movements, so certain to be taken up, through sheer predisposition to them, by every child, that they should be classed here: but as a matter of fact, these are acquired imitatively, or even taught, and I do not wish to extend the range of instinct too widely. Certainly it does not seem wise to include under it any movements that involve the use of a tool, even so simple a tool as a missile, — though I have necessarily spoken of striking with a stick in connection with striking with the hand. I may add that of all forms of using a weapon or tool, this striking with a stick seemed the most instinctive, — far more so than throwing.

In many other movements besides those here described, an instinctive element is very plain. Many expressive movements, as laughing, are purely instinctive. On the other hand, in most of the instinctive movements, as walking, the constant use of volition and adaptive intelligence was strikingly evident. It is as impossible to distinguish sharply between instinctive and deliberate action as between reflex and instinctive. I must classify according to the element in the action that seems to predominate, or to be of the more importance and interest.

Again, the presence of instinct affecting rather the central than the motor activities was often to be detected: there were strong instinctive elements in the emotions, for instance. These I shall call attention to when I come to them, but shall not attempt to disentangle from their more obvious connections, to class them in the present chapter.

In all the types of movement described in the foregoing pages, race inheritance, not individual intelligence, has been the control-

ling element. The gap between these and ideational movements, in which the interest rests not in the movement itself but in the central activity which it expresses, is so wide that it does not seem to me logical to group them together, in a classified record. I close the subject of Movement, therefore, with the following summaries, leaving intelligent movements to be recorded under categories belonging to the Intellect.

SUMMARY AND TABLES RELATING TO THE NON- IDEATIONAL MOVEMENTS.

I.

SPONTANEOUS MOVEMENTS:¹ Characterized by entire absence of purposiveness:—

Table 1. Spontaneous Movements.

1. Purely spontaneous movements. Due to diffused stimulus from <i>growth of lower motor centres</i> . Gradually inhibited by co-ordinated movements, but surviving somewhat in sleep for several years.	1st to 3d months. [Mrs. Moore, 1st to 5th; Preyer, 1st to 7th.]
2. Similarly irregular movements, not purely spontaneous but due to diffused stimulus from <i>heightened general sensation</i> . Passing under ordinary conditions into regular expressive movements, but surviving always as irregular <i>excess</i> movements of expression.	1st to 3d months. [Preyer, 1st to 7th.]
3. Accompanying movements, due to diffused excess of <i>voluntary motor stimulus</i> , or <i>strain of attention</i> .	From 6th week. [Mrs. Moore, from 9th week; Preyer, from 8th month.]

¹ Dr. Mumford's recent ingenious theory, which treats these as *survival* movements dating back to the aquatic ancestry of man, must not be entirely ignored here. The obvious objection to the theory is the enormous antiquity of the survival: it seems incongruous that at a stage of development when structure is of a distinctly primate type, and the muscular condition reveals traces of the *arboreal* stage (as Dr. Robinson has plausibly shown), the prevailing movements should lapse back to a stage so inconceivably more remote. Even if the theory be accepted, it does not dispose of the classification of these movements as spontaneous in origin; it simply accounts for the *form* they take, as the diffused stimulus passes into the easiest, because most ancient channels. But many of the movements—as the asymmetric movements of the eyes, the grimacing, the rolling of the head—certainly can not be brought under the theory at all.

II.

REFLEX MOVEMENTS: Involuntarily purposive. Following immediately on peripheral sensation, without necessity of central action, and along well-established paths (Preyer).

Table 2. Commoner Reflexes.

EARLIEST DATE OF APPEARANCE.	MOVEMENT.	OBSERVER.	LATER DATES OF APPEARANCE.
1st day.....	{ Swallowing ¹ ... Sneezing..... Crying..... }	Many observers.	
1st day.....	Clasping ²	Moore.....	{ 4th day — Sully. 5th day — Preyer. Very early—Shinn.
1st day.....	Starting ³	{ Preyer..... Champneys..... }	{ 3d day — Moore. 3d or 4th — Shinn. 1st fortnight — Darwin.
1st day.....	Hiccoughing.....	Preyer	{ 1st week — Tracy. 28th day — Shinn.
1st day — 5th day..	Choking.....	Preyer.....	{ 1st week — Tracy. By 80th day—Shinn
1st day — 1st week	Coughing.....	Preyer	{ 1st week — Tracy. 42d day — Shinn.
1st week.....	Yawning ⁴	{ Darwin	{ Before 42d day — Shinn.
1st week.....	Stretching ⁵	Darwin	42d day — Shinn.
14th day.....	Throwing up arm ⁴ .	Preyer.....	{ 23d day — Shinn. Before 49th day — Moore.
1st fortnight.....	Winking ⁵	Darwin	{ 23d day — Shinn. 44th day — Hall.
42d day	Rubbing eyes..... (With yawning and stretching.)	Shinn.	

¹ Prenatal, according to Preyer.

² Prenatal, according to Champneys. Preyer speaks of it as usual in the newborn, but does not report it in his own observations till 5th day.

³ Classed by Tracy as "impulsive," or spontaneous.

⁴ Purposiveness is not very evident in such reflexes, but they seem survivals of escaping or defensive movements, retaining still a certain character of the sort, while the definiteness of their character and their immediate relation to peripheral stimulus distinguishes them clearly in actual observation from the mere overflow movements classed as "spontaneous."

⁵ Not the mere *closing* of eyes at bright light, which may be seen from the first.

III.

INSTINCTIVE MOVEMENTS:— Purposive, in part consciously, in part unconsciously. Hereditary and racial, but developed largely under influence of individual experience and volition.

1. *Purely instinctive:*— Sucking, licking, biting, smacking, thrusting out objects with tongue; turning head; striking, kicking (at objects); stiffening, relaxing, or wriggling away (to escape a hold); pulling against resistance; paddling to keep afloat in water; walking movements.

2. *Developed by effort, following on strongly instinctive impulse:*— Holding up head; sitting, pulling self to sitting position, or raising body by abdominal muscles; kneeling, standing, walking, running, climbing.

3. *Selected movements, but determined largely by instinct:*— Grasping; raising self to sitting position sidewise or backward; rolling, creeping, rising to knees, sitting on heels; spitting out; sniffing; pushing and pulling.

4. *Imitative, and scarcely instinctive at all:*— Jumping.

Table 3. Development of Grasping: Transition from mouth to hands as grasping organ.

	MOUTH AS GRASPING ORGAN.	HANDS AS GRASPING ORGAN.
1st month.		
1st 3 weeks.	Special sensibility (passive) in lips and tongue. Sucking instinct. Tendency of hands to prenatal position, accidentally getting to mouth.	Reflex clasping.
4th week.	<i>Seizing with lips</i> and sucking a surface brought in contact with them.	
5th week.	<i>Groping movements with head</i> , to aid mouth grasp.	
2d month.		
7th week.	Appearance of <i>active touch</i> in tongue. Precocious effort to carry object to mouth, repeating an accidental movement.	
9th week.		Signs of special sensibility (passive) in finger-tips.

Table 3.—Continued.

	MOUTH AS GRASPING ORGAN.	HANDS AS GRASPING ORGAN.
3d month.		Longer clasping. Thumb reversed.
10th week.	Efforts to get hands to mouth. Hands carried constantly to mouth, sucked and mumbled.	
	Objects in hands carried unintentionally to mouth with hands: association forming between the movement, and touch sensations in lips and tongue.	<i>Hands closed mechanically on objects touched.</i>
12th week.	Thumb carried to mouth at will and sucked. <i>Reached by diving head down</i> as much as by carrying thumb up.	Appearance of <i>active touch in fingers</i> . Longer and more or less conscious clasping. Pulling to raise self. Fumbling about for objects, and picking up deliberately when touched either by palm or back of hand, — <i>first hand-grasping</i> , by feeling only.
13th week.	Deliberate efforts to put objects in mouth.	
4th month.		
14th week.	Objects when felt often sought with head, to grasp with mouth.	Growing skill in picking up objects. <i>Both hands used</i> for heavy object.
15th week.	Growing skill in putting objects in mouth. Yet relation of hand and arm movements to touch sensations in mouth still imperfectly understood, as shown by blunders.	
16th week.		Objects seen, then fumbled for, and grasped when touched, — <i>approach to true grasping</i> . <i>First attempt to grasp by visual guidance</i> (118th day).
At 16 weeks, (113th day.)		
17th week.	Attempts to grasp with mouth or tongue by visual guidance (119th day).	
5th month.		
18th week.	Grasping with mouth, by diving head at object, more frequent and skilful than grasping with hand.	Slow improvement in grasping, — still largely groping, and grasping on contact.
19th week.	Objects grasped solely for purpose of getting them to mouth.	

Table 3.—Concluded.

	MOUTH AS GRASPING ORGAN.	HANDS AS GRASPING ORGAN.
20th week.		Great advance in skill.
21st week.	<i>Simultaneous</i> grasping with hands and mouth. Mouth put to object <i>after</i> the clutch with hands. Simple manipulation of object, instead of immediate putting to mouth.	
6th month.	Head put down to grasp only when object does not move readily under hands. Mouth-grasp disappearing.	Seizing toes, with skilful co-operation of ankle. Usually <i>both</i> hands used, object cautiously inclosed between them. Practically no errors in distance or direction. Grasping now the chief and absorbing interest, — everything reached for. More varied handling, greatly increased skill: <i>e. g.</i> , heavy glass marble, 1½ inches diam., held in one hand, and ball, 2 inches, in the other. Yet still clumsy, thumb not always reversed, etc.
7th month.	Objects less promptly carried to mouth, sometimes not at all.	Toes carried skilfully to mouth.
8th month.		Decline in interest in grasping, superseded by interest in locomotion. Swift snatching appears.
9th month.		Grasping with <i>finger-tips</i> quite imperfect.
10th month.	Objects rarely carried to mouth. ¹	Finger-tips more skilful; pin picked up with ease; single hair played with. Right forefinger tip differentiated for delicate investigation.

Table 4. Priority of Mouth in Touch and Prehension.

STAGE OF DEVELOPMENT	MOUTH.	HAND.
Special passive sensibility	In lips and tongue, <i>1st week</i>	In fingers, <i>9th week</i> .
Grasping, on contact.....	With lips, <i>4th week</i>	With hands, <i>10th week</i> .
Groping, to grasp	With head, <i>5th week</i>	With hands, <i>12th week</i> .
Active touch	With tongue, <i>7th week</i>	With fingers, <i>12th week</i> .
Grasping.....	With mouth, by head-movement, more frequent and skilful, <i>up to 20th week</i>	With hand, by arm-movement, more frequent and skilful, <i>after 20th week</i> .

¹ Recurrence of practice two or three times in the second year.

Table 5. Sequence of Stages to Hand-Grasping.

1. Reflex clasping.
2. Hands often felt by lips and tongue, in connection with certain involuntary arm-movements.
3. Renewal of these sensations sought by voluntary repetition of the arm-movements.
4. Sensations increased and varied by touch of objects, accidentally brought to mouth, after being mechanically clasped.
5. Deliberate groping for and laying hold on familiar objects, in familiar place, to carry to mouth (*i. e.*, repetition of movements that have often resulted in accidentally carrying objects to mouth: extension of the association series).
6. Hands and objects *seen*, while grasping takes place; formation of visual association also.
7. Grasping at objects visually located, for sole purpose of carrying to mouth.
8. Grasping for varied purposes, manipulation, inspection, etc., as associations increase in number and variety.

It will be seen that my record of the development of grasping completely confirms Preyer's in the following respects: —

(1) The origin in (*a*) reflex clasping; (*b*) tendency of the hands to move upward, accidentally reaching the mouth; (*c*) the sucking instinct.

(2) The slow growth (*a*) of mechanical holding to an object once clasped, the thumb gradually becoming reversed (a stage which I saw by the ninth week, however, Professor Preyer not till the fourteenth); and (*b*) of laying hold on objects accidentally touched.

(3) The final appearance of true, visually guided grasping at the end of the fourth month, — even in the same week, the seventeenth, in which he saw it.

(4) The slow growth afterward of good co-ordination between thumb and fingers, and neat grasping.

I can not find, however, that he observed at all: —

(1) The persistent *voluntary* carrying of hands, and afterward of accidentally clasped objects, to the mouth, *before* true grasping, — an action which according to my analysis above was an essential stage in forming the association series that brought about true grasping.

(2) The period of fumbling for objects, and grasping purposely but *without visual guidance*, — a period that lasted a month in the case of my niece, and brought the motor and tactile associations involved in grasping to considerable perfection, before the visual element was added.

(3) The appearance of active touch about tongue and lips, and efforts to seize with the *mouth*, which in my record clearly precede active touch and prehension in the hands.

With regard to these three points of difference: —

1. Mrs. Moore's and Mrs. Hall's records agree with Professor Preyer's and mine in recognizing the early movement of hands to face and mouth, and the early clasping, as involuntary; and in noticing the period of gradually longer and more deliberate clasping that preceded true grasping. They also confirm my observation of a period of carrying the hands to the mouth with unmistakable intention, before any intentional grasping was observed. No observer but myself, however, seems to have noticed any distinct period of carrying to the mouth *objects held in the hand* (at first those involuntarily clasped upon contact, and afterward those groped for in familiar places), before true grasping: but Sully has several notes implying some such period; Darwin places the habit of carrying things to the mouth so early (twelfth and thirteenth weeks) that it probably preceded grasping; and both Mrs. Moore and Mrs. Hall place the first true grasping so early (eleventh week and twelfth week) that it seems probable they classed as true grasping an early type which I agree with Preyer and Vierordt in thinking only apparent.¹ If the latter view is correct, Mrs. Moore's observation that this early stage passed into the later one through a period in which *the hand was watched while grasping took place*, confirms mine and my analysis above (Table 5) in a striking manner. In the case of my niece, others about the child believed that she was really grasping with intention and visual guidance some time before I did. If my analysis in Table 5 is correct, grasping is largely an empiric act, reached through con-

¹ *The Senses and the Will*, p. 246.

secutive series of associations. If, on the other hand, the first visually guided grasping comes without some such succession of stages, it must be regarded as much more purely instinctive than in my interpretation. I shall show in a later publication the bearing that this question has on my observations as to the visual perception of space and form.

2. The noticeable period of *feeling for* objects and grasping upon contact, in the case of my niece, was doubtless due to the fact that she was from the twelfth week propped among cushions in a chair, with convenient objects on the tray before her, where she learned to expect to find them. To this gradual acquirement of muscular co-ordinations was also due, perhaps, the caution and accuracy of her grasp from the first, and the use of both hands, while Preyer's child often estimated distance and direction wrong, and for weeks used only one hand.

3. As to the mouth-grasp, it may have been an individual trick in the case of my niece, or may be an essential stage in development, overlooked by other observers; the question should be settled by farther observation.² Professor Preyer, though an almost infallible observer, was so prepossessed by the idea of *taste* association in his interpretation of the early importance of the mouth in consciousness, that he may have failed to notice some significant indications of its part in touch and prehension. But traces of such a stage appear in his record, and in those of several other observers: his child brought the mouth down to an object that did not move readily under the hands, just as my niece did; Mrs. Moore's groped for the breast with the head, in the second week, and afterward, in the ninth, made *reaches* for it with head and neck; while Sully's, in the nineteenth week, made efforts to seize a biscuit with the mouth.

The following table will show how my observations of the stages of development in hand grasping compare chronologically with those of others. I enter in it only such stages as are reported by other observers besides myself.

² As these pages go to press, I find that I had overlooked Tiedemann's distinct note of a passing habit of mouth grasping, confirmed by Perez; but neither observer assigns it to a definite place in the development of grasping.

Table 6. Grasping: Comparative Chronological Table.

	SHINN.	MOORE.	PREYER.	HALL.	SULLY.	WOOD. ¹	SHARP. ¹	BEATTY. ¹	DARWIN.
Groping with head for nipple.....	5th week.	2d week.	.....	.....	.....	.....	.....	.....	.....
Prolonged holding.....	9th week.	6th week.	14th wk.	9th wk.	.....	.....	.....	.....	.....
Reversing thumb.....	9th week.	12th wk.	12th wk.	.....	.....	.....	.....	.....	.....
Carrying hand purposely to mouth.....	9th and 10th wk.	10th wk.	.....	8th wk.	.....	.....	.....	.....	.....
Grasping upon accidental contact {	10th and 12th wk.	10th wk. and 8th wk.	12th wk.	.....	.....	.....	.....	.....	.....
Reaching with head and neck.....	12th wk.	12th wk.	.....	.....	.....	.....	.....	.....	.....
Active feeling with hands.....	12th wk.	10th wk.	.....	.....	.....	.....	.....	.....	.....
Feeling for and grasping object <i>actually</i> located.....	12th wk.	.....	.....	.....	11th wk.	4½ mos. ²	.....	.....	.....
Carrying objects purposely to mouth.....	13th wk.	6th week.	.....	12th wk.	19th wk.	4 mos. ²	At 3 mos.	19th wk.	12th and 13th wk.
Hand watched while grasping.....	15th wk.	13th wk.	.....	.....	.....	.....	.....	.....	.....
Groping toward object seen.....	At 16 wks.	12th wk.	.....	.....	.....	.....	.....	.....	.....
Grasping objects <i>visually</i> located, true hand-grasping.....	17th wk.	12th wk. ³	17th wk.	11th wk.	26th wk.	.....	.....	.....	.....
Definite efforts to grasp with mouth objects <i>visually</i> located.....	17th wk.	.....	.....	.....	19th wk.	4 mos.	.....	.....	.....
Playing with toes.....	20th wk.	21st wk.	.....	.....	.....	.....	.....	.....	.....
Handling objects, instead of putting at once to mouth.....	21st wk.	.....	.....	12th mo.	.....	.....	.....	.....	.....
Getting toes into mouth.....	22d week.	.....	32d wk.	.....	.....	29th wk.	.....	.....	.....
Using the two hands for different purposes.....	21st wk.	33d week.	.....	.....	.....	5 mos.	.....	.....	.....
<i>Stiff</i> grasping.....	8th mo.	18th wk.	.....	.....	.....	.....	.....	.....	.....
Playing with a single hair.....	38 wks.	18th wk.	10 mos.	.....	.....	.....	.....	.....	.....
Differentiation of forefinger.....	40th wk.	34th wk.	.....	.....	.....	.....	.....	.....	.....

¹ MS. records. ² First and second child. ³ If this grasping in the 12th week were to be regarded as the "apparent grasping" noticed by Preyer and myself about the same date, and if the later type of the action seen by Mrs. Moore in the 15th week be considered the first true grasping, the parallel in stages of progress between her record and mine is evident from this table.

**Table 7. Movements of Equilibrium and Locomotion :
Chronological Succession.**

	TURNING HEAD.	BALANCING HEAD.	SITTING.	OTHER MOVEMENTS.
1st Month.				
1st week.	Instinctive or spontaneous rolling of head.			
2d week.		Special innervation of neck muscles.		
3d week.	More appearance of	First efforts to lift head.		
4th week.	volition in turning head to look.			
2d Month.				
5th week.	Head turned freely at will.			
6th week.		Head first balanced erect.		
7th week.	Head first turned while balanced.			
9th week.			Desire for upright positions and effort to hold back erect.	
3d Month.				
11th week.	Head turned freely at will while balanced.	Head balanced perfectly.		
12th week.			Efforts to raise self.	
4th Month.			Sitting with support becomes habitual position.	

[The power of turning and balancing the head having been attained for life early in the third month, I drop these two columns from the table.]

Table 7.—Continued.

	SITTING.	ROLLING.	CREEPING.	OTHER MOVEMENTS.		
5th Month.						
19th week.	Sitting with less and less support, till the slightest steadying is enough.	Turning over from back to side.				
20th week.			Effort to strain forward and reach object, — <i>first attempt at locomotion.</i>			
6th Month.						
24th week.	Sitting without support, with slowly increasing security of balance.	Rolling over from back to stomach.	Approximate creeping movement, without intention.			
7th Month.						
27th week.	Secure sitting as a rule, but occasional fall.	Rolling from stomach to back				
28th week.		Rolling over and over freely.				
30th week.				KNEEL- ING.	STAND- ING.	WALK- ING.
8th Month.						
32d week.				Pulling self to knees and partly to feet.		
33d week.			Random creeping position and movements frequent. Drew self forward, flat on stomach.			
34th week.		Great and joyous activity in free kicking, rolling, twisting about,				
35th week.	Acquirement of sun-dry methods of sitting up at will.	with random creeping movements.			Daily pulling to feet.	
9th Month.						
36th week.		Creeping <i>backward.</i> Rolling from now on abandoned.	Rising freely to knees without support.			First walking movements.
37th week.	Medley of	positions and movements, sitting, kneeling, creeping, scrambling, pulling to feet, &c.				

[The only farther progress under the head of sitting was the learning to sit down backward, in the 15th month, and rolling was abandoned, so I drop these two columns from the table.]

Table 7.—Continued.

	CREEPING.	KNEELING.	STANDING.	WALKING.	CLIMBING.
10th Month 40th week.	Disappearance of varied movements by selection of best adapted, especially standing and creeping.				
41st week.	Rapid and free creeping.		Constant efforts to stand alone. Standing alone a few seconds.		
42d week.		Dropping from feet to knees, holding to support.			Letting self down by hands, from chair.
43d week.				Stepping along, holding to support.	
44th week.					Pulling self up step.
11th Month 45th week.			Rising to feet without help. Standing alone securely.		
46th week.	Creeping on hands and feet, rather than hands and knees, to the end of the year.				Climbing up and down stairs. Efforts to climb boxes, chairs, etc.
47th week.				Walks led by one hand, but no inclination to do it.	
48th week.					
	Incessant joyous activity, standing up and sitting down, edging, creeping, and climbing about.				
12th Month 50th week.				A few steps alone, at first coaxed, at last voluntarily.	Bold, free, and constant climbing throughout the month.
51st week.					

[Kneeling and standing had now been for some two months well acquired (it remains only to note that standing on one foot was seen in the 29th month); and as creeping was abandoned during the thirteenth month, I drop these three columns from the table for the second year.]

Table 7.—Concluded.

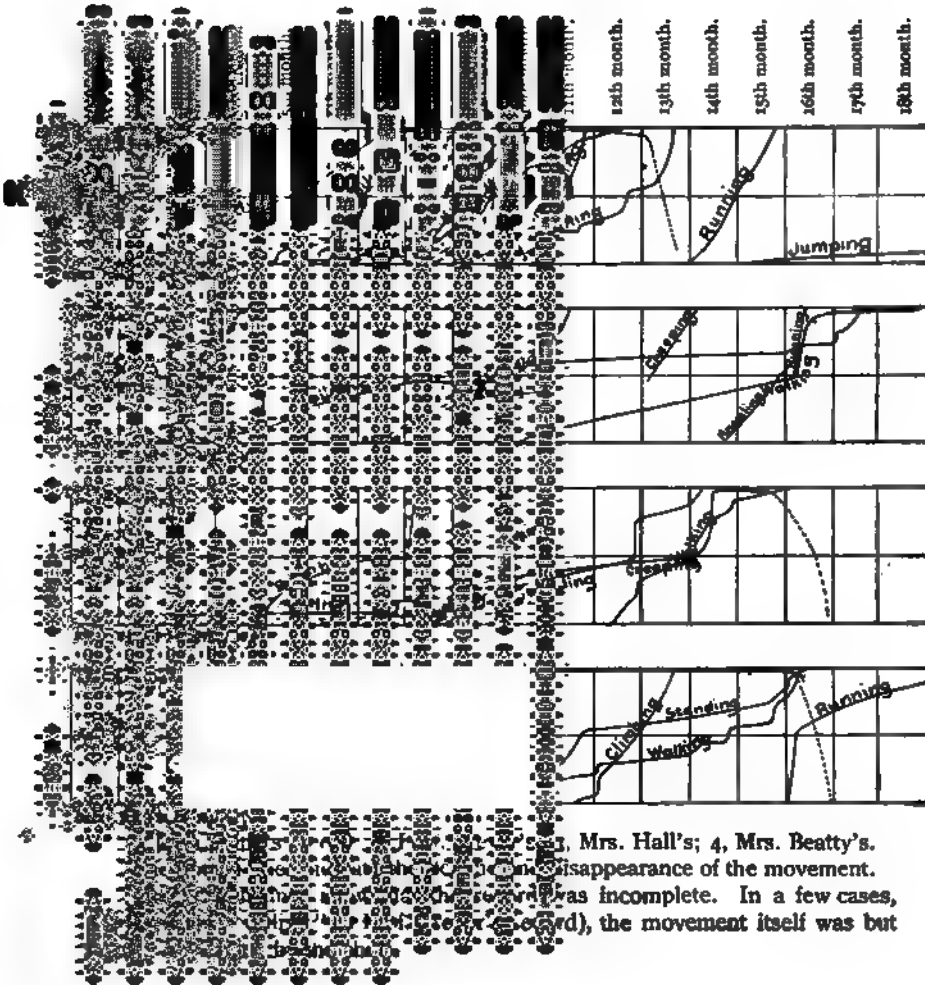
	WALKING.	RUNNING.	CLIMBING.	JUMPING.
13th Month				
53d week.	Walking freely, steadied by finger.			
54th week.	Across a room alone.		Climbing perpetually increases in skill and variety throughout month.	
55th week.	Walking alone with secure balance, turning, bending, stepping over slight obstacles.			
56th week.	Toddling freely about garden, hundreds of feet.	Gait increased when eager to a sort of trot.		
14th Month	Incessant toddling about.	Almost runs when eager, — clumsy trot.		
15th Month		Trotting a great deal.	Perpetual desire to climb, and growing ability: increased heights constantly climbed.	Imitative efforts to jump.
16th Month	Walking almost abandoned for the trotting gait.			
	Walking backward.			
17th Month	Stepping up and down, — downstairs without help.	Running about untiringly, with joy and exultation. Still trips often.	Into chairs. Into high chair.	
18th Month	Stepping upstairs without help.			
19th–24th Months	Incessant and joyous activity. Distances up to mile or more. Still occasional tripping.		Ladders from 21st month.	Acquired at 23 months, and zealously practiced.
3d Year			Unflagging zeal in climbing. Trees climbed 30th month.	Never a common movement: jumping <i>down</i> occasionally practiced
	Last note of tripping in 29th month.			

The diagrams on the opposite page summarize the chronological succession of the movements very briefly, and compare my results with those of the other observers who have recorded at all fully the *process of acquiring* these powers. Most observers give only the *date of acquirement* of each movement recorded by them.¹

I have tried to supplement these diagrams with a comparative table of such dates as are afforded by the reports of other observers: but so many of these are unavailable for comparison (for the reasons given in the foot-note¹), that I abandoned the effort after any complete comparison, and contented myself with a mere table of extreme dates (Table 8), which will give an idea of the range of variation so far recorded. It should be noted, however, that in several cases earlier dates are reported than are given in the table, but not in such terms that I can be certain of the stage of development really meant: thus, for example, two of the Talbot papers report children as "sitting alone" at five months old, but I cannot tell whether this means that secure sitting alone for minutes together, on a perfectly level surface, was really attained.

The table shows plainly that the American children were more active in acquiring the earlier movements: the full text of the

¹Such bare dates are of little use even for mere comparison of the periods of completion in development, because in the gradual process each observer may set down a different stage as marking practical completion. He records, for instance, "Sat alone at six months old." Does this mean that the child for the first time succeeded in balancing for a second or two, or that sitting with secure balance was acquired as a habit for life? In the case of my niece, three months intervened between these two stages. Did the child sit on a cushion, lap, or other yielding surface, affording even the slightest support about the buttocks, or on a flat, hard surface? My record shows two weeks between these stages, and Mrs. Wood's a month, while Preyer also noticed that sitting on the hard level was a more difficult and later achievement. Does "standing alone" refer to the first successful balancing, or to secure equilibrium for minutes at a time? After the former stage was attained, it took Mrs. Hall's boy two months to reach the latter; my niece required three months, and Preyer's child not less than *eight* months, the whole process of learning to creep, walk, and run coming in between. Even the order of succession of the movements is valueless for comparative purposes when we do not know what stage of the process of acquirement the note refers to; this is evident by a glance at the diagrams, with reference to the question whether creeping came before or after kneeling, for instance, in my record, or standing in Preyer's and walking in Mrs. Hall's.



records shows them on the whole somewhat in advance of the European children in standing and walking (though the European children began earlier), and notably so in climbing. The difference may well be due to the degree of freedom allowed in dress and position; and the very fact of restriction in the earlier movements may hasten the beginning of the later ones.

No regular difference between girls and boys, in strength, precocity, or method of acquiring the movements, can be detected from any evidence so far attainable. The resemblance in these respects between an American girl and an American boy seems closer than between an American boy and a German boy. But the number of records is too small to justify any generalization here. It is a reasonable presumption that small, light children will be earlier in acquiring balance and locomotion, and this accords with the general impression of mothers and nurses; and the statistics tend to show that girls are smaller and lighter than boys in the earliest years, though according to Dr. Burk (*Growth of Children in Height and Weight*) the difference is not marked nor conclusively established.

Table 8. Extreme Dates of Acquiring Instinctive Movements.

MOVEMENT.	EARLIEST DATE RECORDED.	LATEST DATE RECORDED
Holding head— 1st effort.....	1st day { Wood Talbot Papers, case E, two children }	.....11th week, Preyer.
Habit.....	11th week, Shinn .....	.....24 weeks, Demme.
Sitting— 1st effort	10th week, Wood .....	.....18th week, Hall.
Habit	26th week { Wood } { Shinn }	.....11 months, Demme.
Standing— 1st effort	18th week, Sigismund .....	.....14th month, Preyer. ¹
Several min- utes alone ...	40th week, Demme.....	.....70th week, Preyer.
Walking— 1st movements	19th week, Champneys .....	.....41st week, Preyer.
Free walking alone	8 months, Sigismund .....	.....24th month, Demme.

¹ Not his own observation; reported from "trustworthy parents."

The following appear to me the most important results brought out by my own record of the movements of equilibrium and locomotion, checked by comparison with other records:—

1. The rudimentary origin and gradual development of some of these movements. Thus, holding up the head seemed to develop out of a mere special innervation of the neck muscles, at times of heightened general stimulus; sitting began with a mere stiffening of the back against a support; creeping defined itself out of a medley of experiments in moving the body and limbs about. In some cases the steps of development seemed largely empiric, in others instinctive, and in some cases (notably in that of walking), the first sign of the movement seemed completely instinctive: but on the whole, careful watching seemed to reveal a more gradual process from smaller beginnings — to analyze the movements down into simpler elements, so to speak — than one would suppose from casual observation. The same thing seems to be true even of the very precocious instincts of young animals, Professor Morgan and Doctor Mills finding some little development from imperfect beginnings where the earlier observers had seen only instincts innately complete.

I do not find that any other observer reports quite so primitive beginnings in these movements as I do; but I suspect this is rather because the observer has not cared to push his record so far back than because such primitive stages did not occur.

2. The marked priority of the movements of the head, trunk, and arms over those in which the legs took part. There were two distinct periods, — one (extending through the first seven months) in which the main development was in sense perception, together with the closely correlated power of grasping, but in which balancing and turning the head, sitting, and rolling, followed in distinct succession; and another (extending through a half-year more) in which the main activity was in the development of locomotion and of equilibrium in the erect position, the movements developing alongside each other with much less distinct order of succession.

These two periods are clearly evident in the notes of other observers, though their duration varies. In all the records we have, the movements of the first period follow in strikingly similar succession, though Mrs. Hall omits record of balancing the head, and Preyer's child apparently was never given the opportunity to develop rolling. Mrs. Beatty and Mrs. Sharp do not record the earlier periods at all.

3. The late and empiric development of creeping. If we are to regard this movement as a survival of a four-footed mode of progression, it is curious to find it so late, after sitting and rolling, even after standing and a fair degree of progress in walking: yet all the observers agree as to this tardy development of creeping.¹ Moreover, it is the most uncertain and variable of all the instinctive movements. The use of hands and knees, which is more common than that of hands and feet, is perhaps easily accounted for by the length of the human leg; but this is the least of the variations. My niece drew herself forward with her elbows, flat on her stomach, before she could creep; Mrs. Sharp's eldest boy did the same; Preyer says of the first creeping, "Can creep, or rather drag himself along somewhat." Mrs. Wood's elder boy propelled himself "in measure-worm fashion," and her younger one wriggled along, and later drew himself forward with his arms, and at one time learned to steer himself in rolling, and used that as a means of voluntary locomotion instead of creeping; Mrs. Hall's boy hitched along in a sitting position before he could creep. Every one has known of babies who with every opportunity never creep at all, hitching or rolling instead; and Dr. Le Conte tells me of instances in which the creeping is tripedal, one leg being trailed along idle. It is curious to see so often reported an involuntary *backward* movement (highly displeasing to the child, whom it takes directly away from the objects he is trying to reach), immediately preceding successful creeping: so in my record (above, p. 340), Mrs. Beatty's (below, p. 420) and Mrs. Hall's.² In some cases, as in that of Mrs. Wood's younger boy (below, p. 424), there seems to be a strong instinctive impulse toward proper creeping; but on the whole the impulse is vague, urging only to locomotion of some sort, in striking contrast to the definite instinct which sets the baby's legs mechanically to executing the alternate motions of walking, late and difficult though that movement is in race history.

If we are to regard creeping as a survival, its late appearance and uncertainty may be due to its slight usefulness in human life,

¹ Preyer mentions a child who began to creep in the fifth month; but it is not his own observation, and I know of no other case so early.

² Child Study Monthly, Vol. II, p. 403.

or to human customs of dressing and tending infants, — to swaddling-bands and skirts, to constant holding in the arms, or confining in baskets, pouches, and cribs. No doubt it has been of inestimable value to the race that infants have been thus protected from exposure and accident; but it may have involved a minor disadvantage in breaking up a normal creeping period. Mrs. Wood's record and mine both note early attempts at creeping, abandoned in favor of rolling, a movement much more practicable in skirts. It would be worth while to observe whether nude babies, left free in warm climates to tumble about on the ground, creep earlier. It is, however, possible to doubt whether four-footed locomotion was ever much developed in the direct line of human ancestry (see below, p. 416).

4. The early development of climbing — in advance of walking — and also the strength of the climbing instinct. Mrs. Beatty's record corroborates mine strongly in this (p. 421). Mrs. Sharp mentions climbing before standing and walking alone (p. 423); and so also does Mrs. Wood, if we are to understand the "creeping upstairs" in the tenth month (p. 423) as properly climbing. Mrs. Hall does not record this movement at all, and Preyer alone places it late, in the third year. There are many indications that Professor Preyer's child was given far less opportunity for spontaneous muscular activity than the American children, and climbing is a movement quite dependent upon free opportunity; so that I think the other records on the whole confirm mine as to its early importance. Mrs. Chapman (whose notes I have several times quoted in the preceding pages) did not keep regular record of the instinctive movements, but writes me that her three children all climbed before they could walk, and that a neighbor's baby, eleven months old, is now climbing, though unable to walk; and several other cases are reported to me.

When we observe the method of climbing, placing the knee or foot on a higher level and pulling up by the hands; when we observe also that the first kneeling and standing come from a strikingly instinctive tendency to pull the body upward with the hands, which shows itself very clearly in the development of sitting also; and when we add to this Dr. Robinson's well-known demonstration of the monkey-like clinging power of infants' hands from birth, — we

can hardly fail to question whether standing and kneeling may not have *originated in climbing*, the feet or knees braced on a lower branch, while the hands clung to a higher one. I do not overlook the important influence that the use of the upper limbs for grasping and striking would have had in bringing the body erect and relegating locomotion to the lower limbs: but in my observations striking came later than climbing; and though developed grasping came much earlier than developed climbing, the rudiments of both, reflex clasping and strong clinging, are alike present at birth.

During an arboreal period which developed standing and kneeling, and perhaps sitting also, progression on the ground would have been on all fours. But as I have hinted above, we are not obliged to suppose that this sort of locomotion ever reached any high development. If we follow those zoologists who regard the edentates (including the arboreal sloths) as representatives of the earliest generalized type of placental mammals, and the lemurs as representatives of the earliest primates, we trace human ancestry through types which were never free runners on all fours, and which may have led an arboreal life during the whole period, merely crawling slowly on the ground.¹ The still highly general type of the human hand is against the supposition that it was ever to any great extent used as a foot. Here we have, perhaps, a better reason for the late and variable development of creeping than the one suggested above (p. 415).

¹ Going even back of the edentates, we have the marsupials, with their strongly arboreal tendency. The indications seem to point to a life more arboreal than terrestrial in our direct line of ancestry almost or quite back to the first divergence of mammalian from amphibian types. It is worth observing that any arboreal animal too large to keep its young in holes in trees, like squirrels, must necessarily give them greater care than a terrestrial animal, which can leave them on the ground: they must be constantly held in pouch or arms, and carried about. Here would be a strong agency in bringing about that care of helpless infancy which, according to Prof. Fiske, is the origin of our humanity. Mrs. Chapman writes of one of her boys that he "climbed persistently and in most dangerous places, preferably up the waste pipe at the side of the house, and up perpendicular scantlings, until about seven or eight years old, when he suddenly stopped, and has never showed any particular love of climbing since." This passionate impulse to climb, declining at six or seven years old, is, I think, not uncommon. It is evident that it falls in well with the theory of a long arboreal life, ending somewhere about the early human period.

5. The remarkable joy, pride, and physical exhilaration attending the acquirement of some of these movements. This appears more or less in all records, though in several cases the pleasure was marred by timidity, which my niece never experienced to a painful extent.

6. The similarity, on the whole, in the manner of development of the movements in different children. On casual comparison the variations are most striking; but on close examination of the records the only important difference seems to be that a movement is sometimes held back a long time, either by lack of opportunity or lack of confidence, and is then executed suddenly,—a well-known occurrence in case of artificially delayed instincts, as when young birds are prevented from flying till beyond the usual time. For the rest, certain details of the process of development recur in the different records to a noticeable extent: as the wriggling or pulling forward before true creeping, and the involuntary backward creeping before the forward movement is mastered (p. 414); the pulling to the feet, first by some low object so that the body is still partly propped by the arms, then by a higher (p. 342, and also Mrs. Beatty's note, p. 420), and later yet the rising from all fours. The postponement of standing alone till after walking, walking till after running, in the case of Preyer's boy, seem to be distortions of the usual order, due to deferring of the instinct, through timidity; and this timidity Preyer thought actually increased, to the delay of the development, through efforts to hasten walking and standing; and Mrs. Beatty had a similar impression with regard to her boy (p. 421).

Some pedagogical conclusions are clearly indicated:—

1. It seems evident that the infant should have by the second quarter-year the utmost freedom of limbs and opportunity of movement on the floor that is possible without exposure to cold or accident. Any such exposure, however, is more serious than the restriction of muscular development: so that to avoid both evils may demand vigilant care. If the mother is so circumstanced that she can give this watchfulness, she should not grudge the trouble: it requires a kind of devotion not often to be expected from a servant. A year-old baby, for instance, may be allowed extensive

climbing, to his physical and mental advantage, if some one is so close at hand, and so unfailing in attention, that the little one cannot slip without finding himself instantly safe in arms.

2. While there is no harm in some little encouragement where it seems needed, any more than in the birds' teaching their babies to fly, it need hardly be said nowadays that none of these movements should be urged and hastened, and especially that the baby should not be allowed to bear his own weight, in sitting, standing, or walking, till he is unmistakably able to; nor is it desirable to urge a feat of balancing upon a timid child, even when he is plainly capable of it, lest he get fixed associations of fear with it, and be actually held back in progress. For the scientific observer's purpose, of course, the more absolutely spontaneous the development the better always. But where a child has become discouraged, or has been held back a long time by timidity, a little cautious coaxing past the sticking-point may be the wisest thing pedagogically. Nothing can take the place of motherly common sense in such a matter.

3. From the time the child has fairly mastered the race movements, the mother should be alert to notice any special clumsiness of gait or bearing, and to determine, by comparison with other children, whether it is a mere natural phase of growth, or the beginning of a fixed individual trick. It will scarcely define itself as the latter within the first three years, but it will often do so in the next two or three; and whenever it does (I may here go beyond the limit of this record to say), if there is available a competent authority in such matters, able to determine the exact fault of muscular development that causes the trick, and to prescribe plays and movements that will gently correct it, the mother should consult him. The freest activity of the healthiest child is not a guarantee of symmetry. In the first difficulties of balancing, babies may throw themselves into bad attitudes that become fixed habits. Or they inherit feeble development of this or that muscle, which is therefore neglected in use, and becomes still feebler; and where it fails in its due tension, the opposite muscle over-pulls the bone, and the distortion in time becomes fixed in the bony structure. Thus very little children may be caught habitually standing on one foot, resting on the heels with abdominal muscles relaxed, dropping

the shoulders forward, etc., — tricks that are not only ungraceful, but likely to produce spinal curvatures, narrowed chests, and other serious physical ills. There is little use in the mother's trying to correct such faults, for all she can do, even with older children, is constantly to warn them to correct their positions; the weak muscle can be pulled to its place for the moment by an effort, but the instant attention is withdrawn, the muscle relaxes, and nothing is gained. Yet the faults, even where they are strongly hereditary, are corrected with singular ease in these early years by special exercise, as I know from the case of my niece, who at seven years old showed remarkable improvement in her whole carriage, as the result of exercises, within a month. Symmetrical muscular development, however, is not ordinarily included in the range of a physician's studies; nor do many physicians care to occupy themselves with a child's turned-in toes or slovenly way of sitting. Until competent gymnasium teachers, therefore, are far more numerous in the community, it will often be impossible for the mother to get proper advice about matters of gait and bearing. In that case, it will be better for her to trust to the utmost *general* freedom and activity of the body than to take risks from ignorantly prescribed special treatment.

Table 9. Instincts Connected with Food-Taking.

EARLIEST DATE OF APPEARANCE.	MOVEMENT.	OBSERVER.	LATER DATES OF APPEARANCE.
At birth.....	Sucking	Preyer and other observers	[I do not know of any recorded case in which this movement did not appear on the first opportunity, usually 1st day; cases are indefinitely reported in which it was at first very imperfect.]
1st day.....	Licking.....	Preyer .....	.....2 months, Shinn.
1st week.....	Thrusting out nipple...	Shinn .....	.....3d to 5th week, Preyer.
3d month.....	Smacking....	Shinn .....	.....11th month, Preyer.
15th week.....	Biting	Shinn .....	.....By 17th week, Preyer.
10th to 20th months..	Spitting out.	Shinn .....	.....

Of the other instinctive movements, described on pp. 392-5, there is not enough record made by other observers to be worth comparative tabulating.

MILICENT WASHBURN SHINN.

OTHER RECORDS OF THE INSTINCTIVE MOVEMENTS.

FROM MRS. BEATTY'S MS. RECORD (see p. 22).

In the eighth month the baby was trying to creep, rising on hands and toes, but in his first efforts he pushed himself involuntarily backward. This always made him angry, as he kept getting farther and farther away from the object he was trying to reach. This continued till late in the eighth or early in the ninth month. During the ninth month, he was in camp, and had no opportunity to creep except on the bed; but I saw him one day creeping forward across the bed; and after this he could steer in the direction he wished to go. After returning home he crept quite rapidly, turning out his toes. In the eleventh month he sometimes crept on hands and knees, and sometimes on hands and toes.

By this time (eleventh month) he was pulling himself to his feet, but only by rather low objects, as a cracker-box [so that his weight was partly propped by his hands, as in the case of my niece at the same stage: see p. 342. *M. W. S.*]; but by the middle of the month he would get to his feet by almost any object, his mother's skirt, e. g. He could now stand by a chair, and keeping hold with one hand could lean over and take things from the floor. He rarely lost balance, and daily gained more ease and confidence in standing. In the forty-seventh week, however, as he stood by a light kitchen chair, which moved a little over the uncarpeted floor as he pushed against it, he became alarmed, drew back, stood alone for a second, then sat down suddenly, crying with fright.

About this same time, the middle of the eleventh month (forty-sixth week), he made an important advance toward walking. He was standing by his mother's knee, and desired to investigate the contents of a basket on a chair near by. Reaching out with one hand, he steadied himself by the chair; then letting go his mother's dress with the other hand, he tried to find a hold for it on the chair. He had some difficulty in doing so, bent over to take hold of the rung, and finding that would compel him to stoop, at last placed both hands on the seat of the chair, and stepped over to it. In the forty-eighth week, as he stood by the lounge, he reached out his hand and caught his mother by the dress, then by the hand, and by pulling managed to step over to her. In the next few days he became able, by taking my hand, and pressing his other hand against a wall, to step along slowly; and he would edge all about large, heavy chairs, holding to them. The last day of the month he was shown how to push a light chair before him over a matting-covered floor: he was highly delighted with this mode of locomotion, and moved rapidly about the room with the chair, although less than a fortnight earlier he had been so frightened at the slight moving of a chair under his hands.

In the latter part of this same active month, the eleventh, he began to let

himself cautiously down by his arms from the lounge, — at first not unless some one was close beside him; but in the forty-eighth week he repeatedly did it quite alone. I was told in this week that he had climbed up on the lounge alone, but I thought it very doubtful.

During the next three months creeping continued a constant habit. One or two indispositions, and still more, lack of confidence, delayed the baby's progress toward standing and walking alone, and in the latter part of the fourteenth month he still stood alone only when he became interested in something and forgot to hold on; at such times he now and then fell over. In the sixtieth week he once took a squatting position, preparing to rise to his feet; but only because he expected me to take his hands and help him; and when I did not do so, he dropped down on hands and knees.

He gained gradually in steadiness in walking by a support, and seemed able to walk alone, but made no effort to do so. By the end of the thirteenth month he could walk pretty well by taking hold of one of my fingers, but he preferred to cling to my dress at the same time, with the other hand. He now usually walked quite fast. By the end of the fourteenth month, he needed but the slightest hold on my finger to walk easily; he could push a chair all around the dining-table, and if it encountered any obstacle could turn it without help; could walk along by merely putting his hand against the wall: but any effort to have him walk quite alone caused such excitement and timidity that we did not urge him. At last, in the sixtieth week, he took a step alone without knowing it, when I had released my hold on his arm. A few days later he took three steps to reach me, and the same day his father vouched for four steps, in my absence.

His progress in climbing during this period was more vigorous. In the latter part of the thirteenth month he had a perfect fever for climbing. He would mount to a stool by means of a chair close by; would climb over the rockers of the rocking-chairs; try to climb into boxes; scramble up on the lower shelf of a stand on one side, and off it on the other; etc.

In the fifteenth month, the child for a time seemed to have gained no confidence from his successful steps alone in the fourteenth; so that in the sixty-fourth week his father and I began to coax him to walk from one to the other; and by gradually increasing the distance lured him thus to walk across the room alone several times. After this if I took his hand off a chair, he would walk alone, but would not voluntarily quit his support till near the end of the week (the sixty-fourth). On the same day on which he first took his hand thus off a chair to walk alone, he started to walk from his grandmother to me, but when he had gone half way, and I held out my arms to receive him, he suddenly whirled about and walked back to his grandmother, evidently pleased that he had played a joke on me. He repeated this joke several times in the next few days. The day after, he left his uncle's knee to walk to his box of playthings across the room, and get something he wished; and after this he frequently walked alone, though he would still become timorous, and drop

down and creep. It did not trouble him to step over door-sills, though up to the end of the month (fifteenth) he never tried them unless some one was close by to catch him in case of accident. He walked with his arms raised and hands stretched out toward the object he was aiming at, and often balanced himself before starting out.

Early in the sixteenth month (sixty-sixth week), he was walking freely all over the house, and with much less difficulty of balancing, though he still raised his arms somewhat. He often walked easily over door-sills, though sometimes they seemed to trouble him. He still dropped down to creep often, losing confidence. On the 459th day, in walking from one object to another, he would run the last few steps, thinking it great fun. He improved daily in walking, and early in the sixty-seventh week had abandoned the practice of holding his hands up to balance; I even saw him walking with an object in each hand, and another in his teeth. He had comparatively few falls, and was less disposed to drop down and creep. By the middle of the month, if he lost his balance he would pick himself up and go on. In the sixty-eighth and sixty-ninth weeks, he was quite ill, and became so weak that he staggered when he walked; but as soon as he was well, returned to his walking energetically, and though not very firm on his legs, would not creep at all.

Up to the sixty-sixth week he had still crept a great deal, especially when he felt uncertain on his feet, or happened to sit down on the floor, or was not near anything by which he could pull himself up. He was in these last weeks of creeping fond of going about on hands and feet, and could travel quite fast. But by the sixty-seventh week creeping had visibly declined, and in the sixty-eighth it was quite rare; by the last week of the month, it seemed entirely abandoned.

Standing alone made no progress till the child had acquired some confidence in walking; but by the beginning of the sixteenth month he stood alone boldly in the middle of the floor, and stooped over and picked things up. In the next week (sixty-sixth), he lifted himself up to his feet from all-fours: and by the middle of the month could get up this way quite readily; if he stepped on his dress, he would work his feet about till he got them free, then stand up.

The mania for climbing is again recorded in the sixteenth month, the stairs now being the special object of desire. In the twentieth month the child first succeeded in mounting into a large chair, and displayed the feat with charming pride when his father came home.

In the latter part of the nineteenth month walking was abandoned for a trotting gait.

FROM MRS. SHARP'S MS. RECORD (see p. 21).

ELDEST BOY.

At just six months old the baby worked himself forward, trying to reach something on the floor: he was lying face down, and stretched his arms forward, bent at the elbows, and resting on his fore-arms, drew his body forward. He began to creep in the latter part of the seventh month.

The first week of the twelfth month he walked alone, a distance of three or four feet between two chairs.

YOUNGEST BOY.

In the latter part of the seventh month, when laid on his back, the baby turned over on his face and turned back again with ease, without bumping his head, — the first time I had ever seen him do it.

By the tenth month he crept rapidly. In the first week of this month he would pull himself up to his knees, and make violent efforts to get on his feet. He could do it with slight help, but could not bear his weight on them.

In the first week of the eleventh month he still needed a little help in getting to his feet. Yet in this same week he could take a few steps pushing a chair, and could edge along the length of a sofa.

At a year old he walked by chairs and walls and other slight support. When his four-year-old brother called him to play "choo-choo," he would pull himself to his feet by the back of his brother's dress, and trot slowly round the room after him. At the same age, he climbed into a double rocking-horse, and stood erect, holding the edge of a blackboard with one hand, while he marked on the board with a piece of chalk in the other.

FROM MS. RECORDS OF MRS. EDITH ELMER WOOD, B. L., SMITH COLLEGE.

ELDER BOY.

At four months old, if supported by a hand under the body, the baby would prance the length of a bed on his hands and feet. In the sixth month he could propel himself for short distances in measure-worm fashion. He had already, however, in the fifth month, become able to roll over without help, and in the seventh month began to occupy himself with this movement, instead of learning to creep. Meantime, by the middle of the sixth month, he had become able to sit alone on a bed, and by the end of the month on the floor.

It was not until the ninth month that he rather suddenly began to creep, and within a week after the first step on hands and knees was creeping across the room without stopping. In the tenth month he would creep upstairs. In the same month he could stand, holding by a chair, and in the eleventh he stood alone. In the eleventh, too, he could walk a few steps, holding some one's hand, and could travel across the room, pushing an inverted waste-basket before him. In the twelfth he could take six or eight steps alone, and walked quite well with the aid of some one's hand.

In the thirteenth month he could run alone, and in the fourteenth could walk up and down stairs with the aid of a hand. By the sixteenth month notes implying perfectly free and confident roaming about occur, — chasing the cat, for instance; and in the twentieth he was a great little gad-about, always seizing you by the hand and commanding you to "'m 'on!" In the nineteenth month he was very active in climbing on chairs, tables, etc., and tried to climb trees: in the twentieth and twenty-first also varied and skillful climbing is noted.

YOUNGER BOY.

The baby made efforts to lift his head on the first day, raising it clear from the pillow.

Early in the third month, when propped at an angle of 45° , he would lift himself to a sitting position, tipping over at once; and when flat on his back, he would lift his head and shoulders clear. He had a great desire to sit up. At three months old he could sit alone on a bed, but his balance was still insecure at five months old. At six months he could sit alone on the floor.

In the eighth month he tried hard to creep: he would place himself on hands and knees correctly, and move his hands, but could not move his legs after them, and would soon, therefore, be flat on his stomach, after which he would wriggle along. Toward the end of the month he resorted to rolling, and though he could not at first steer well, he could move about the floor quite rapidly, and in the ninth month learned to steer himself well. In the tenth month he would pull himself over the floor by his arms and by pushing with his feet.

It was not until the thirteenth month that he at last began to creep properly. He could by this time take a few steps, pushing a chair in front of him; and by the end of the month he could walk about pretty well, holding to a finger.

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